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PREFACE

This issue of the *Bulletin* is principally devoted to papers prepared for a meeting of the Sumerian Agriculture Group in Cambridge in June 1984, and concerned with legumes and oil-seed crops. It begins, however, with the second part of Gordon Hillman's survey of traditional cereal processing in Turkey, and some further contributions on legumes have been reserved for the third volume for reasons of space and time.

Several of the articles in this volume appear to vindicate F.R. Kraus's spirited defence of sesame against the negative evidence of archaeobotany. The realization that the plant may have been first introduced only in the middle of the 3rd millennium offers a partial explanation of its absence from the archaeological record, raises the intriguing question of its origins, and should underline once again the value of collecting botanical material from historical, and not only prehistoric, sites.

With the legumes our meeting, and these papers, have served more to cast doubt on the translations frequently given in the Assyriological literature, than to establish convincing alternatives. It seems likely that the chick-pea should not be the principal pulse crop of the south, and that some form of Broad Bean or of the Field Pea could be considered as alternative translations. In the course of our discussions we became aware of the dearth of information about the traditional processing of legumes, and we hope that it will be possible to present some details in the next volume of the *Bulletin*.

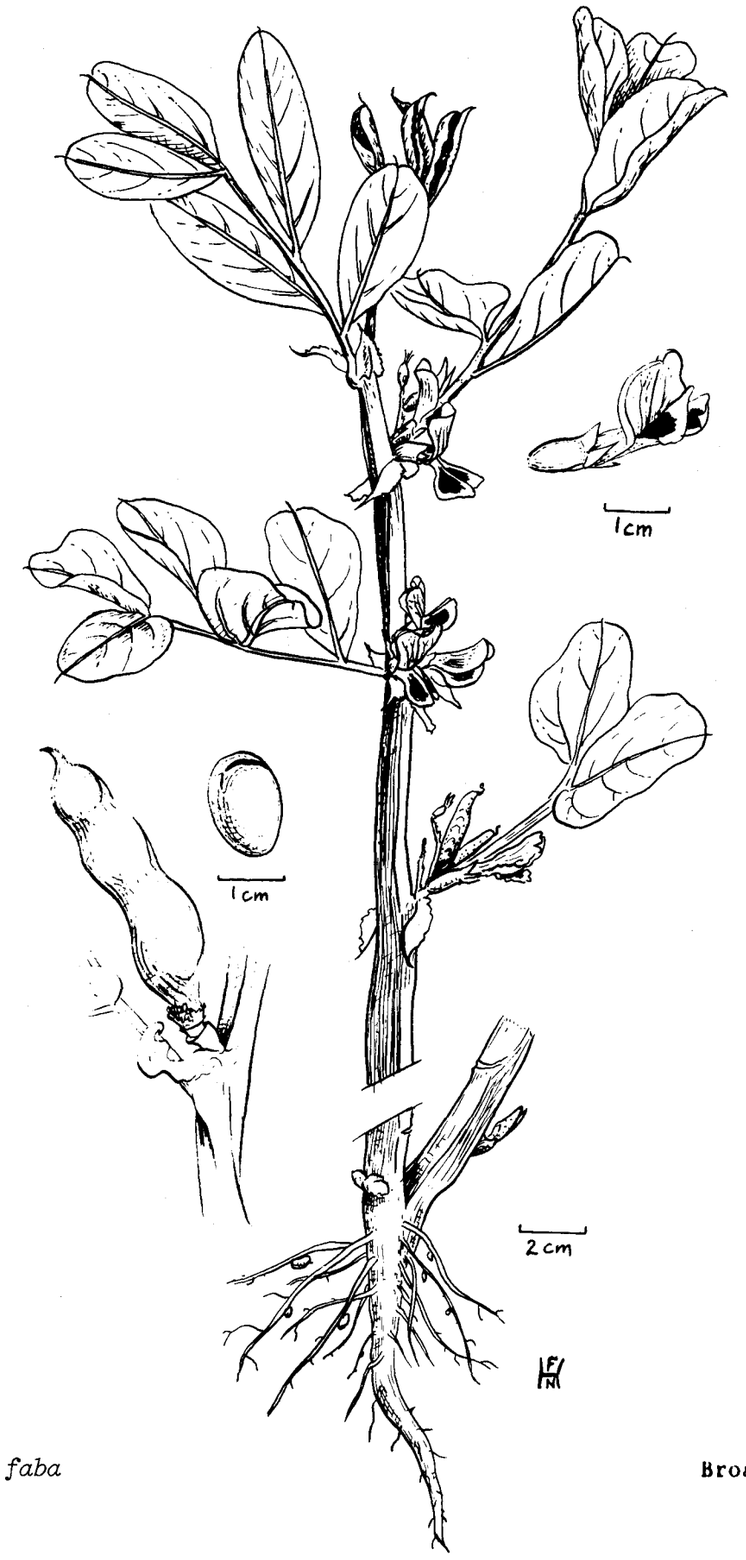
The 1985 meeting of the Sumerian Agriculture Group discussed onions and related plants, Cucurbitaceae, and fruit trees. Articles on these topics will be published in Vol. 3, but as before the Editors will gladly consider other contributions on the general subject of early Mesopotamian agriculture.

For bibliographical abbreviations to cuneiform texts not otherwise explained, the reader is referred to the two standard Akkadian dictionaries: W. von Soden, *Akkadisches Handwörterbuch* (AHw) and the Chicago *Assyrian Dictionary* (CAD).

Once again our thanks go to the College of Liberal Arts and Sciences, Northern Illinois University, Dekalb, Illinois for their generous help with the production costs, to the C.H.W. Johns Fund, and to Trinity College, Cambridge, for hospitality and other support. We are also grateful to Mrs. Laura Cordy (Trinity College) for help with the setting of this volume, and not least to F. Nigel Hepper for providing his admirable illustrations.

Nicholas Postgate
Marvin Powell

October 1985



Vicia faba **Broad bean**

TRADITIONAL HUSBANDRY AND PROCESSING OF ARCHAIC CEREALS IN RECENT TIMES: THE OPERATIONS, PRODUCTS AND EQUIPMENT THAT MIGHT FEATURE IN SUMERIAN TEXTS

PART II: THE FREE-THRESHING CEREALS

Gordon Hillman
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It was stressed in Hillman 1981 that different grain crops require different systems of husbandry and processing, and that this fact has clear implications for any archaeologist attempting to assess the degree of sophistication of ancient technologies in the rural setting. The differences are obvious even in North European agriculture, but are still more striking in areas where traditional agrarian expertise is still extant, as it is in parts of Turkey, for instance. Even within the cereals, we encounter substantial differences in both the husbandry applied in the field and in the processing applied to the harvested crop back in the settlement. Most striking, however, are the differences between methods applied to glume-wheats and those applied to the free-threshing cereals. It is for this reason that the sequences of operations applied to either class of cereal have here been outlined separately.

Part I, dealing with the husbandry and processing of glume-wheats, was published in the previous volume of this series (Hillman 1984b). Because the glume-wheats were the principal wheats of pre- and proto-historic western Eurasia, the glume-wheat sequence was outlined in some detail. In the following outline of the sequence of operations applied to *free-threshing* cereals, it is therefore necessary to describe only those operations which differ significantly from those already outlined for the glume-wheats in Part I. For all other operations, the details given in Part I apply equally to the free-threshing cereals. Indeed, the reader should be reminded that all the ethno-agricultural papers of other workers which were cited in Part I involved observations of the operations *applied to free-threshing cereals*. They were cited in Part I because they represented good additional examples of operations which I had also observed being applied to glume-wheats. Nevertheless, although many of the operations are the same, the composition of the products is always different in free-threshing cereals compared with those of glume-wheats. (Some of the major differences are outlined in Hillman 1981).

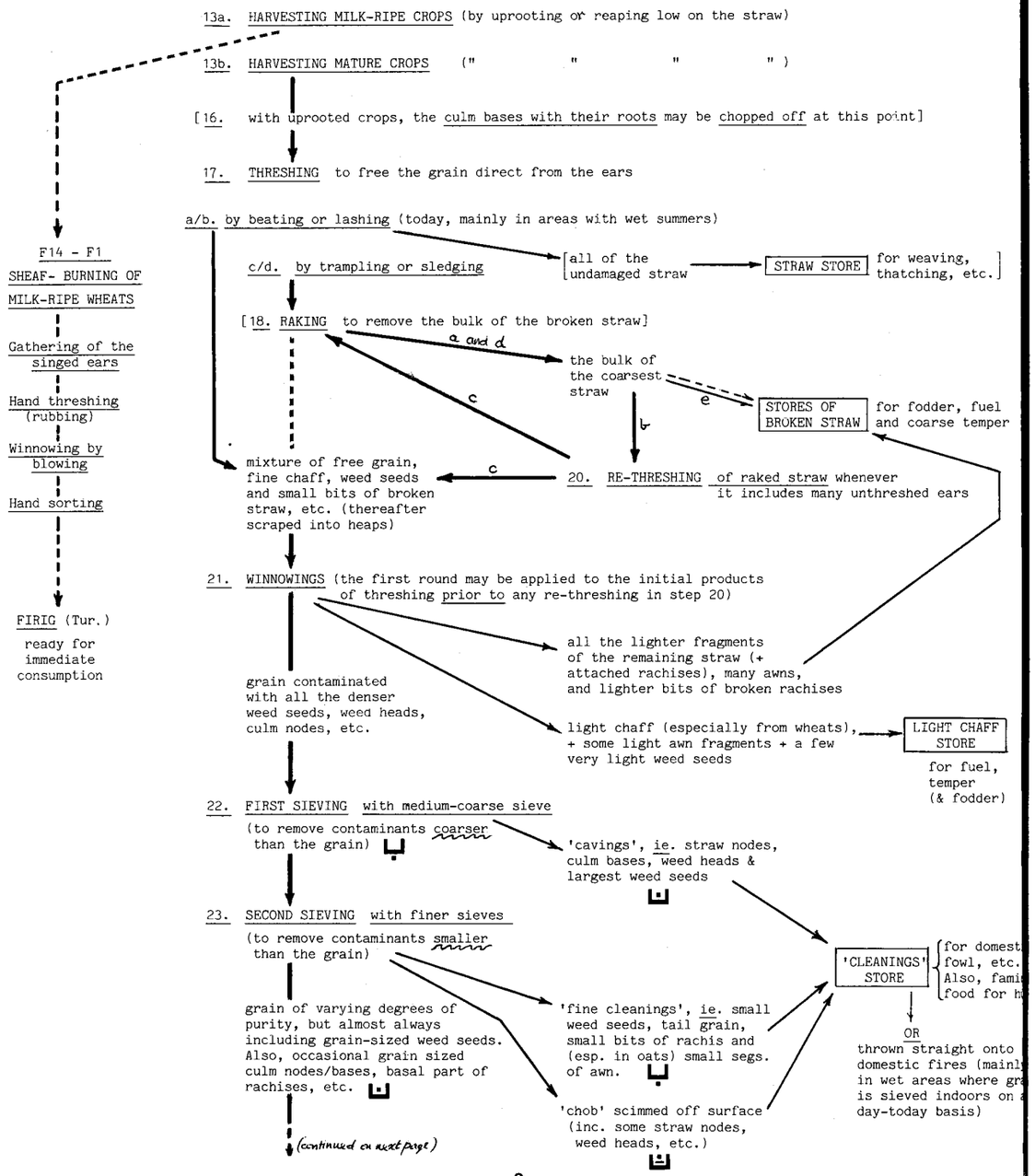
The full sequence of operations applied to *free-threshing* cereals is summarised in Fig. 1. The ethnographic studies were undertaken primarily in Turkey, and for the Turkish terminology applied to all the early stages of grain processing, the reader is referred to the equivalent stages of Part I.

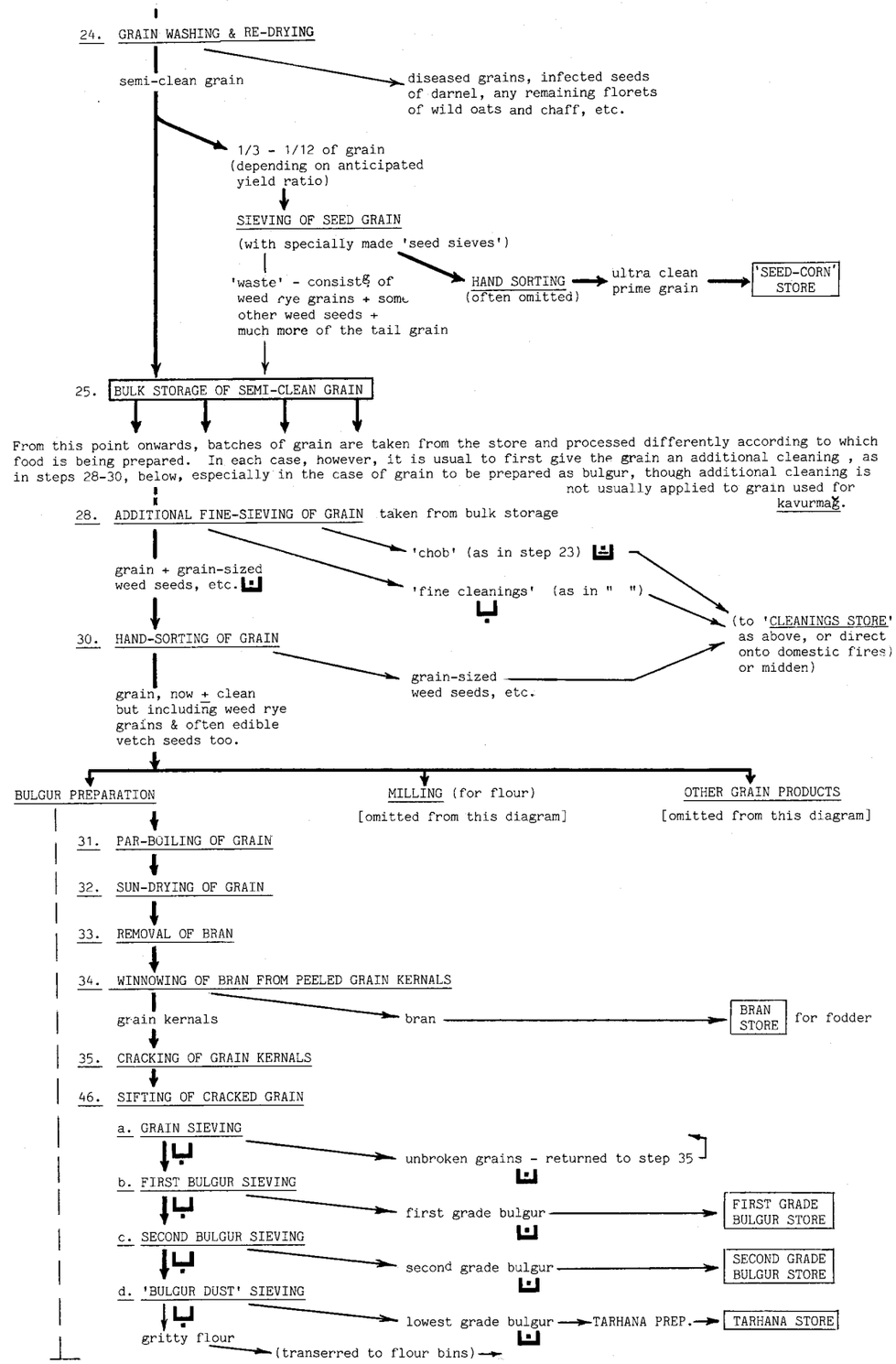
THE TRADITIONAL PROCESSING OF FREE-THRESHING CEREALS IN CENTRAL AND EAST TURKEY:

THE MAJOR OPERATIONS AND PRODUCTS - FROM HARVESTING ONWARDS

Each operation is assigned the same number as that used in the text. Most of the operations which have no effect on the composition of products have been excluded. To further limit the complexity of the diagram, I have omitted any reference to a) differences in processing and product composition arising from ears being harvested separately from the straw, b) the preparation of Frikkē from dough-ripe grain, c) the sheaf-burning of ripe cereals (see text). '⊔' identifies those products and by-products which are retained in the sieves; '∪' identifies those which pass through the sieves; ⊔ identifies that fraction which works its way to the surface of material retained in the sieve.

(Adapted from similar diagrams in Hillman 1981 & 1984)


13a. HARVESTING MILK-RIPE CROPS (by uprooting or reaping low on the straw)
13b. HARVESTING MATURE CROPS (" " " ")
[16. with uprooted crops, the culm bases with their roots may be chopped off at this point]
17. THRESHING to free the grain direct from the ears
a/b. by beating or lashing (today, mainly in areas with wet summers)
c/d. by trampling or sledging
all of the undamaged straw
STRAW STORE
for weaving, thatching, etc.
[18. RAKING to remove the bulk of the broken straw]
a and d
the bulk of the coarsest straw
STORES OF BROKEN STRAW
for fodder, fuel and coarse temper
mixture of free grain, fine chaff, weed seeds and small bits of broken straw, etc. (thereafter scraped into heaps)
20. RE-THRESHING of raked straw whenever it includes many unthreshed ears
21. WINNOWINGS (the first round may be applied to the initial products of threshing prior to any re-threshing in step 20)
all the lighter fragments of the remaining straw (+ attached rachises), many awns, and lighter bits of broken rachises
grain contaminated with all the denser weed seeds, weed heads, culm nodes, etc.
light chaff (especially from wheats), + some light awn fragments + a few very light weed seeds
LIGHT CHAFF STORE
for fuel, temper (& fodder)
22. FIRST SIEVING with medium-coarse sieve
(to remove contaminants coarser than the grain)
'cavings', ie. straw nodes, culm bases, weed heads & largest weed seeds
23. SECOND SIEVING with finer sieves
(to remove contaminants smaller than the grain)
'CLEANINGS' STORE
for domest
fowl, etc.
Also, fami
food for h
grain of varying degrees of purity, but almost always including grain-sized weed seeds. Also, occasional grain sized culm nodes/bases, basal part of rachises, etc.
'fine cleanings', ie. small weed seeds, tail grain, small bits of rachis and (esp. in oats) small segs. of awn.
'chob' scimmed off surface (inc. some straw nodes, weed heads, etc.)
OR
thrown straight onto
domestic fires (mainl
in wet areas where gr
is sieved indoors on a
day-today basis)
(continued on next page)
F14 - F1
SHEAF- BURNING OF MILK-RIPE WHEATS
Gathering of the singed ears
Hand threshing (rubbing)
Winnowing by blowing
Hand sorting
FIRIG (Tur.)
ready for immediate consumption


24. GRAIN WASHING & RE-DRYING
semi-clean grain
diseased grains, infected seeds of darnel, any remaining florets of wild oats and chaff, etc.
1/3 - 1/12 of grain (depending on anticipated yield ratio)
SIEVING OF SEED GRAIN
(with specially made 'seed sieves')
'waste' - consists of weed rye grains + some other weed seeds + much more of the tail grain
HAND SORTING (often omitted)
ultra clean prime grain
'SEED-CORN' STORE
25. BULK STORAGE OF SEMI-CLEAN GRAIN
From this point onwards, batches of grain are taken from the store and processed differently according to which food is being prepared. In each case, however, it is usual to first give the grain an additional cleaning , as in steps 28-30, below, especially in the case of grain to be prepared as bulgur, though additional cleaning is not usually applied to grain used for kavurmaḡ.
28. ADDITIONAL FINE-SIEVING OF GRAIN taken from bulk storage
'chob' (as in step 23)
grain + grain-sized weed seeds, etc.
'fine cleanings' (as in " ")
(to 'CLEANINGS STORE' as above, or direct onto domestic fires) or midden)
30. HAND-SORTING OF GRAIN
grain-sized weed seeds, etc.
grain, now + clean but including weed rye grains & often edible vetch seeds too.
BULGUR PREPARATION
MILLING (for flour)
[omitted from this diagram]
OTHER GRAIN PRODUCTS
[omitted from this diagram]
31. PAR-BOILING OF GRAIN
32. SUN-DRYING OF GRAIN
33. REMOVAL OF BRAN
34. WINNOWING OF BRAN FROM PEELED GRAIN KERNALS
grain kernals
bran
BRAN STORE
for fodder
35. CRACKING OF GRAIN KERNALS
46. SIFTING OF CRACKED GRAIN
a. GRAIN SIEVING
unbroken grains - returned to step 35
b. FIRST BULGUR SIEVING
first grade bulgur
FIRST GRADE BULGUR STORE
c. SECOND BULGUR SIEVING
second grade bulgur
SECOND GRADE BULGUR STORE
d. 'BULGUR DUST' SIEVING
lowest grade bulgur
TARHANA PREP.
TARHANA STORE
gritty flour
(transferred to flour bins)

HUMMELLING OF BARLEY (gen. for fodder) and the DEHUSKING OF BARLEY & OATS (for human consumption) have been omitted from this diagram through lack of space.

WHAT ARE FREE-THRESHING CEREALS?

Free-threshing cereals are those in which the grains fall free when the ears are threshed. (Contrast the 'glume-wheats' - as defined in Part I, 146 footnote 1). They include macaroni wheat (*Triticum durum*), bread wheat (*T. aestivum*), club wheat (*T. aestivum* var. *aestivo-compactum*), Indian dwarf wheat (*T. sphaerococcum*), all the ryes (*Secale cereale* agg.), all the barleys (various *Hordeum* spp.) and all the oats (various *Avena* spp.), for which see van Zeist's classification in BSA 1).

"Naked" and "hulled" grains In the most common varieties of barley and oats, the grains freed by threshing are still tightly enclosed within the innermost layers of husk (hull), namely the lemma and palea (for illustrations see Charles 1984, 28). Such varieties are termed "hulled". There are, however, certain varieties of oats and barleys in which the grains, when they fall from the ear during threshing, leave behind their enveloping lemmas and paleas (inner husks) along with all the rest of the chaff. Such varieties are termed "naked", and today are rarely grown outside Tibet, parts of China and Japan, although they used to be grown throughout the Near East and Europe in the Neolithic and, in some areas, through into later periods as well. The hulled forms differ in needing an additional operation to remove the husk. However, this operation is *not* strictly analogous to the freeing of glume-wheat grains from their spikelets. (Note: all the free-threshing wheats are naked-grained anyway; there is no such thing as a free-threshing wheat with a hulled (husked) grain. To avoid a difficult "tongue-twister", therefore, free-threshing wheats can conveniently be termed "the naked wheats"). For a comprehensive review of the terms used to distinguish naked and hulled grains in Classical sources, see Moritz 1955.

For the farmer, the principal difference between hulled- and naked-grained varieties of barley and oats are as follows: **a)** Hulled forms are less susceptible to (though far from immune to) bird damage. **b)** If harvested early enough there is less loss of grain during transport from field to threshing-yard when hulled forms are involved. With present-day, free-threshing cereals in Syria the International Centre for Agricultural Research in Dry Areas (Aleppo, Syria) has recorded transit losses of as much as 10-15% of the gross yield when harvests are transported during the day (ICARDA 1980). Ancient farmers will certainly have been acutely aware of the need to limit this loss by any means available to them. Apart from night harvesting (see step 15 in Part I), one obvious counter-measure might have been to harvest the ears separately from the straw, straight into baskets or sacks in which they could then be transported to the threshing yards without loss. However, this solution involves its own disadvantages.[1] **c)** To produce husk-free grain from hulled oats or barley, an additional de-husking operation is needed (see below). This is likely to have been a domestic operation and commonly performed by women. In replacing naked barleys and oats with their hulled equivalents, therefore, the farmers may well have encountered some resistance within the home. However, hulled barley (but not hulled oats) can be used for human consumption with the hulls still attached. Indeed, I always eat barley muesli and porridge complete with the hulls. Nevertheless, most societies prefer it dehusked, and most are prepared to invest some effort to this end (see barley section

below). That hulled barleys and oats nevertheless replaced the earlier, naked forms is thus a measure of their agronomic disadvantages, in particular, their extreme susceptibility to bird damage.

For Sumer, however, any discussion of naked barley may well be academic, as Renfrew's (1984) summary of the sparse published records of plant remains from sites in Mesopotamia reveals a complete absence of any identifications of *H. nudum*. (For a close analysis of these identifications, see Charles, in prep.). However, it would be surprising if evidence of its cultivation is not eventually recovered from at least some Neolithic sites in the area.

STEPS 1-11. FIELD OPERATIONS involved in cultivating free-threshing cereals are essentially the same as those briefly outlined for glume-wheats in Part I (Hillman 1984b, 115-117). It should nevertheless be stressed that the different crop species and varieties often differ markedly from each other in their optimal sowing times, minimum frequency and duration of irrigation, and in their yield-responses to any one level of irrigation. (For a few examples of yield-responses of traditional crops to even the light irrigation applied under partially rain-fed systems of East Anatolia, see Hillman 1973a, appendix 1).

[An omission from step 3 of Part I:
Broadcast sowing in rows. Harvey (1980, 5) describes a Syrian system of sowing in which "on deeper soils, one pass with the [*feddan*] plough sets up ridges (*'ayar* cultivation); the seed is then broadcast and a second pass (*rdad*) splits the ridges. Broadcast seed tends to concentrate in the *'ayar* furrows and the majority of the seed is therefore buried at maximum depth, which is about 10 cm. Row spacing is about 40 to 45 cm and row band width 10 to 15 cm." In view of the sowing in widely spaced rows indicated in some Sumerian texts (see Maekawa 1984, 77-78 and 87; Postgate 1984, 100), such a system for producing rows without the help of seeder ards or any resort to dibbling is perhaps of interest to Sumerologists.]

12. GUARDING OF RIPENING CROPS The shelters used are mentioned in Hillman 1984b, 117. The present-day costs of paying for the guarding of fields of free-threshing cereals in the Busra area of Syria are usefully summarized by Kadow & Seeden 1983. With free-threshing crops, there is also a greater need for guarding against predation by birds, as such cereals are vastly more susceptible than glume-wheats, especially when they are slightly immature. In experimental plots of cereals near Cardiff we repeatedly had our bread wheat and even our hulled barley stripped by sparrows who, by contrast, quickly abandoned their attempts to extract grain from the ears of Emmer, Einkorn and other glume-wheats growing in plots nearby. Many villages growing free-threshing cereals therefore organise their children to parade around the fields making a din with clappers or by beating cans. They are also encouraged to cull the birds by slingshots or by catching them in snares: a dozen sparrows can provide meat more than adequate for a meal for two.

13. HARVESTING The same three methods are used for free-threshing cereals as were detailed in step 13 of the Emmer sequence in Part I (Hillman 1984b,

117-120). The difference here lies only in the relative popularity of the three principal methods:

a) Uprooting In the present-day Near East, uprooting is most commonly applied to barley - with or without the help of special blunt sickles - the Turkish *kalıç* (see glume-wheats sequence, step 13*a*). Indeed, in most parts of Turkey, it is unusual to see it being harvested by any other method. Elsewhere, however, (e.g. in north China), uprooting is equally often applied to bread wheats (Leser 1931). Pulses are almost always uprooted.

b) Reaping ears and straw together - by cutting low on the straw. This is the method which, today, is most commonly applied to all the free-threshing wheats, ryes and oats.

c) Reaping ears separately from the straw. When this method is applied today, it is invariably to *durum* or bread wheats. Certain problems encountered in this form of reaping were mentioned under step 13*c* in Part I, but as indicated above (p. 4), this method can reduce the heavy grain losses that are often incurred between field and threshing yard. Sigaut (in comment made to Butser symposium 1984) has stressed that it also saves labour during threshing and winnowing, when time is at a premium. However, the problems of uneven ear height typical of many primitive crops (and even some modern varieties if sown late) would surely in some cases have enforced reaping so low on the straw of all taller ears as both to pre-empt these advantages and still to leave stubble tall enough to justify a second reaping (see Part I, p. 119). Nevertheless, Sigaut has ample historical evidence of the widespread use of the "double harvest" in medieval Europe, but concludes that the habit of cutting high on the straw may, in North-West Europe at least, have been conditioned as much by the need for thatching straw as by any other factors (Sigaut, pers. comm., April 1985). Maurizio (1927, 140-1) also gives a clue to a second determining factor: when grain was cut in its half-ripe state (e.g. for product types c, d and i, below), in all the wetter parts of Europe the ears generally had to be oven dried and were therefore cut without their straw.

d) Ear stripping Reference was made in Part I (in a postscript to step 13) to devices for ear stripping, in particular the "plucking clamp" reported by Sigaut (1978) as still in use in the Spanish province of Asturias (*not* the Pyrenees as I had stated) under the name *mesorias* and used there for harvesting the glume-wheat Spelt (*T. spelta*). It transpires that this two stick "plucking clamp" has in recent times also been used to harvest free-threshing wheats, and Sigaut (pers. comm. 1985) informs me that, far from its having been observed in only one restricted area, equivalent tools have been reported in use in Georgia, Armenia, Nepal and Bhutan. He continues: "In addition, the areas where *mesorias*-like tools were used *after* the harvest proper, for separating ears or grains from the culms, are much more numerous than the [above] areas where the *mesorias* are used for harvesting proper" (Sigaut, pers. comm. 1985). He then goes on to cite historical evidence of other forms of post-harvest ear stripping in Europe (e.g. in Württemberg). (I am grateful to François Sigaut for so patiently drawing my attention to the wealth of historical evidence from Europe and the USSR relating not only to harvesting methods, but also to tilling and fallowing.)

e) Ear plucking Sigaut (pers. comm., April 1985) has rightly stressed the importance of distinguishing between plucking ears and stripping them. Plucking, if it is to be seen as a viable method of harvesting at all, seems to be best suited to glume-wheats (see Reynolds 1981) and is unlikely to have been used for harvesting free-threshing cereals on a scale much in excess of gleaning.

For the benefit of archaeobotanists it should perhaps be mentioned that, in glume wheats, plucking involves breaking a rachis internode below the lowest fully formed spikelet of the ears, and thus leaves behind the abortive basal spikelets. By contrast, ear stripping, even when applied to glume-wheats, seems likely to remove the entire ear + the top of the culm in many cases. In archaeological remains of crop products, therefore, the practice of plucking can readily be recognised from *a)* the complete absence of remains of these characteristic basal spikelets in either coarse or fine 'cleanings' (incl. chob), and, *b)* their presence in remains of straw. The practice of sickle reaping, on the other hand, can be established from the opposite pattern of associations in charred remains of these same crop products. (For further details, see Hillman 1981, 148-153).

14. TEMPORARY FIELD STORAGE OF HARVESTED SHEAVES Today, at least, prolonged field-storage is rarely risked with the *naked*-grained cereals (such as the free-threshing wheats) on account of their susceptibility to bird damage. However, prolonged field-storage is not uncommon with hulled barley and oats, except in the smallest farms where (or in drought years when) there are only small harvests to be processed. By contrast, in damp areas and at high altitudes, even free-threshing wheats are subjected to prolonged field-storage - unless indoor drying facilities are available.

15. TRANSPORT OF HARVESTED CROP TO THRESHING YARDS With free-threshing cereals, this occurs exactly as described for glume-wheats in Part I. However, the grain losses during transport are here even greater. Thus, for barley and free-threshing wheats grown in present-day Syria under traditional husbandry, ICARDA 1980 has recorded losses of 10-15% of gross grain yield. Evidence of these heavy losses can be observed during summer in the Near East along any track connecting fields and threshing yards: the ground is strewn with fallen grain destined to end up in rodent burrows, ant nests and the gizzard of sparrows or pigeons.

[Steps **15a** and **16**: precisely as described in Part I (BSA Vol. 1)]

17. THRESHING Precisely the same methods can be applied to free-threshing cereals as those outlined for glume-wheats under step 17 in Part I. However, the results of threshing are altogether different. On being threshed, the grains of free-threshing cereals quickly fall free from the ears, without need of any of the painstaking procedures for parching and pounding the threshed spikelets.

As in the case of the glume-wheats, the harvested culms or untied sheaves are spread on the threshing yards either (i) direct from the carts, or (ii) from heaps formed at the side of the yards or (iii) from heaps

built at the centre of each yard. This last system is most usual when only small quantitites are being threshed, and is usefully illustrated in Koşay 1956 from an example at Karahöyük Village near Kültepe: the *kesmik* is progressively added to the circular *döşek* (lit. a mattress; i.e the layer being threshed) from a large central heap (*tığ*). Precisely the same system is described for the Jebel Alawi in W. Syria by Amr El Azm 1985.

To the references given in Part I citing accounts of the 6 principal methods of threshing should now be added a few more, all of them concerned with threshing by sledge (Tur. *döven*) or tribulum/threshing wain (Tur. *cercer*). Firstly, Williams 1972 cites the use of the *cercer* armed with wood or metal paddles in those southeastern areas of Turkey around Gaziantep and Mardin which, in the past, experienced strong Arabic and Syriac influence. (To my knowledge, the *cercer* is absent from the Anatolian Plateau). Secondly, Amr El Azm 1985 brings a detailed account from the Jebel Alawi of the continued use of threshing wains fitted with sharp-toothed steel disks of the sort which, in most Syrian villages, are now found only in the form of stray sets of rusting disks discarded on middens. (In the El Koum area, for example, we noticed that no village midden seemed complete without them). It is of some interest, however, that El Azm suggests that, in the Jebel Alawi, the steel-disked threshing wain only recently replaced threshing sleds which, in that area (as in parts of Palestine) were fitted with rough basaltic pebbles as illustrated in Kadour and Seeden 1983, plate 23. On the other hand, Christian 1917-18 indicates that the steel-disked threshing wain was widely used around Aleppo in his day, as it was in Palestine at the time of Dalman (1924-42). Finally, a particularly fine example of an Iranian threshing wain with wooden paddles appears in fig. 26 of Lerche and Steensberg 1983.

[Steps 18 and 19: precisely as described for glume-wheat in Part I.]

20. **WINNOWING** With free-threshing cereals there is only a single episode of winnowing, and both straw and light chaff are separated from the grain in the one set of operations along with all lighter pieces of the rachis. As a result, light chaff, falling as a thin spread at a distance from the winnowing and admixed with much of the straw, is rarely scraped together and stored as a separate product as it is in glume-wheats, unless, of course, the ears have been reaped separately from the straw, in which case the winnowing can be undertaken on a smaller scale with lighter winds such that the light chaff is retrievable and storeable as a separate product - for later use as either tinder or fine temper. It should be stressed, however, that this one episode of winnowing of free-threshing cereals invariably involves at least two winnowings in quick succession and is generally thereafter supplemented by re-winnowing after the re-threshing of incompletely threshed ears described below. (For a detailed account of the handling of winnowing forks and the organisation of winnowing with regard to wind-strength and direction, see Dalman 1933, III, 128).

21. **RE-THRESHING AND RE-WINNOWING OF *KESMIK*** Unlike glume-wheats, the heaps of *kesmik* (=light straw from the first round of primary winnowing) from free-threshing wheats invariably contain large numbers of incompletely

threshed ears. This appears to be especially true of crops threshed by trampling. (Compare step 21 of the glume-wheat sequence in Part I). So, once the grain already separated in the first round of primary winnowing has been coarse-sieved (though generally before it is fine-sieved), the *kesmik* is once again spread across the yard, re-threshed and then re-winnowed. Koşay 1951 describes precisely the same practice at Alaca Höyük village: "*döğende ezilmeden kurtulan kelleler kalırsa, ... yaba ile saçar, tekrar döğen koşarık*" ("If, on the threshing yard, there remain ears which have escaped being crushed, ... [then they are] raked up with a winnowing fork, and a threshing sledge is again put to work.") Palestinian parallels for re-threshing free-threshing cereals were cited under step 21 of the glume-wheat sequence in Part I.

[Steps 22-26 and 28-32 of the glume-wheat sequence outlined in Part I are not applied to any free-threshing cereal.]

22. **FIRST SIEVING with medium coarse riddle.** This operation is generally undertaken at the threshing yards. The size of the mesh varies according to the grain being sieved: with wheat, they generally use the *sizmaz gözer*, while with barley they generally use a *sarat*. In both cases, the sieves are designed to just about allow the grain to pass and thus to remove all contaminants coarser than the grain, including weed heads and most of the remaining straw nodes and rachis fragments (trad. Eng. "cavings"). This one operation thus combines the effects of steps 23 and 34 of the glume-wheat sequence outlined in Part I, but the waste fraction here lacks the occasional (often abortive) spikelets found in the equivalent waste fraction from step 34 of the glume-wheat sequence. (Compare fig. 1 of Part I with that of Part II).

23. **SECOND SIEVING with grain sieves with mesh finer than in step 22.** This operation is also usually undertaken out at the threshing yards and, again, different sieves are generally used for wheat and barley (a *buğday kalburu* and *arpa kalburu* respectively). However, when the barley is intended only for animal consumption, then this second sieving is sometimes omitted. Indeed, even when the barley is intended for human consumption, they often dispense with buying in special barley sieves and simply make use of their wheat sieves to eliminate the worst of the small contaminants. (For mention of the traditional manufacture of sieves, see Part I, BSA 1).

This operation performs the same function as step 35 of the glume-wheat sequence in Part I, in that the meshes are woven close enough to retain all the prime grain but allow small weed seeds, short awn segments, small stones and tail grain ("offal corn") to fall through. In contrast to the "fine cleanings" of glume-wheats, however, spikelet forks are absent. A second waste fraction is also separated at this stage, namely the "chob" (trad. Eng.) consisting of fragments of light material which work their way to the surface of the grain where they can be skimmed off. El Azm 1985 further describes how the women sieving grain in the Jebel Alawi, by sieving small quantities at a time and by skilful operation of the sieve can produce three separate aggregations on the mesh surface: prime grain, chob and grain-sized stones. By a deft flick of the sieve they are able

to toss up just the stones, catch them in the other hand, and thus eliminate them. Neil 1913, 112, offers a closely observed account of precisely the same operations in action in parts of Palestine. Yet another useful account of both sieves and sieving is given by Christian 1917-18, who again details the different waste fractions (complete with their Arabic names) and, like Dalman (III, 142) and Kadour & Seeden 1983, stresses the difference between the sieves used for wheat and barley.

The various waste fractions each have their uses (see fig. 1 of this paper, and step 37b of Part I). In particular, the coarser cleanings are used to feed "*büyük hayvan*" (principally cattle), and the "fine cleanings" and "hand sortings" to feed either cattle or, more usually, domestic fowl. (When amalgamated, as they often are, the mixture is used for either group of animals). A similar pattern of use of waste fractions is also recorded for Europe: an eighteenth century agriculturalist Hillman (1710), commenting on Tussar 1573, describes "risk" (seemingly a combination of our "cavings", "chob" and perhaps "fine cleanings") being fed to hogs, and refers to "pickings" (seemingly "hand sortings" with, perhaps, "fine cleanings") being fed to poultry. (I am grateful to Paul Halstead and Glynis Jones for bringing the Hillman text to my notice). For alternatives to fine-sieving, see step 35 of Part I.

24. GRAIN WASHING (AND SUBSEQUENT SUN-DRYING) This operation may be undertaken either at this stage or, in a slightly more piecemeal fashion, as a prelude to *bulgur* preparation and grain milling for flour. (The latter strategy is generally preferred as it relieves the pressure of work during bulk grain cleaning on the threshing yards and washed grain intended for *bulgur* can go straight into the cauldrons without having to be dried first).

The reasons for washing the grain were outlined in step 36 of Part I. Of these, the most important is the elimination of toxic "bunted" grains infected with and entirely replaced by the black, foetid spores of *Tilletia caries* and *T. foetida*.

Grain washing is a common feature of activities around springs, streams and wells of Turkish villages in high summer, a point reinforced by Balaman 1969 and Koşay 1951, 14. It must, of course, be followed by very thorough sun-drying, generally on the flat rooves (*hububat sermeği ve serilerek kurutmağı*).

25. GRAIN STORAGE In free-threshing cereals, the grain is generally stored in only a semi-clean state (as indicated in fig. 1), and it is generally in this state that it is sold. (For differences in this regard between different cereals, see discussion under step 37 in the glume-wheat sequence, and the introduction to the present section on free-threshing cereals, p. 4 above). For mention of systems of measuring grain for sale, see step 37.A in Part I, and for a recent discussion of such procedures in the Old Babylonian period see Veenhof, forthcoming [Ed.].

[26. TRANSPORT OF STRAW AND CHAFF FROM THREHSING YARDS TO BULK STORAGE. ALSO - THE CLASSIFICATION OF STRAW TYPES Exactly as in step 27 of Part I. The details of straw classes given in Part I were, in any case, based on examples taken primarily from the free-threshing wheats.]

27. GRAIN RECOVERY FROM THRESHING YARD ANTS Doughty 1924, II, 417-8 describes a threshing yard in Saudi Arabia where the women were sifting ants' nests for the grain "stolen" by them. His purple prose deserves quotation: "In that yard-side I saw many ant-hills; and drew bridle to consider the labour of certain indigent hareem that were sitting beside them. I saw the emmets' last confusion (which they suffered as robbers), - their ant colonies subverted, and caught up in the womens' meal sieves that (careful only of their desolate living) tossed sky-high the pismire generation, and mingled people and *musheyikh* in a homicide ruin of sand and grain. - And each needy wife had already some handfuls laid on her spread kerchief, of this gleaning corn". (I am grateful to Tony Legge for bringing this reference to my notice, and for explaining the archaic English). It cannot be claimed that the winnowing and sifting of ants' nests is standard agrarian practice. Nevertheless, it is a possibility that Sumerologists should perhaps bear in mind in translating agrarian texts.

That ants are capable of carrying significant quantities of grain down to their underground nest to feed their larvae is supported by observations of the author: more than 250 *Triticum durum* grains per hour were observed being carried from a newly sown field into the entrance to an ants' nest near the site of Çayönü, N. of Diyarbakır (Turkey). The robbery of newly sown grain underlines the necessity of timing sowing to coincide with the arrival of autumn (or spring) rains, thus ensuring the instant germination which alone can pre-empt the predations of ants, birds and rodents. However, it should be added that we have observed ants raiding even a standing crop of barley near Tell Kaya (Syria): whole segments of head were bitten off and carried away by ants swarming up the stems.[2]

[28. ADDITIONAL SIEVE-CLEANING OF ALL GRAIN DRAWN FROM BULK-STORAGE,
29. ADDITIONAL WINNOWING,
30. HAND-SORTING OF GRAIN (PRIOR TO FOOD PREPARATION)

As in steps 38-40 of Part I]

SHEAF-BURNING? I have yet to observe sheaf-burning of mature free-threshing cereals as outlined for glume-wheats in pp. 141-3 of Part I, although just such a practice is reported for some barley crops in the Shetland Isles by Fenton 1978. On the other other hand, sheaves of *immature*, naked wheats are regularly burned to produce special grain products such as *fırıg* and *frikké* (see grain foods *c)* and *d)*, below). In these cases, however, the purpose is somewhat different from the sheaf-burning described in Part I, 141-143. (See fig. 1 for the basic steps of the sheaf-burning sequence).

FOODS PRODUCED FROM GRAINS OF FREE-THRESHING CEREALS

I: FROM FREE-THRESHING WHEATS

a) Roasted grain (Tur. *kavurmağ*, *kavurmaç*, or locally *kavurgalık*). So far, I have seen only the floury-grained forms of naked wheats (and occasionally the barleys) used for roasting. The reason is that floury grains puff up more readily on heating and are less gritty to eat. The usual candidates include the many soft-grained varieties of *T. aestivum* (bread wheat) and the somewhat less common soft-grained varieties of *T. turgidum* (rivit wheat) and *T. durum* (macaroni wheat). (The flinty grains of Emmer would possibly be too gritty).

Grain is taken from bulk storage and submitted to the same additional cleaning operations as those that precede *bulgur* production from glume-wheats, described in steps 34, 35 and 36 of Part I. To the clean wheat grain are then commonly added a handful of the flavoursome fruitlets of *Pistacia terebinthus* (terebinth tree; Tur. *mavi merlengeç*) or *P. atlantica* (which is generally picked in its slightly unripe state). In addition, they often toss in a few chick-peas, lentils, cannabis seeds, barley grains or even a few of the spicey anti-flatulent seeds of fennel (*Foeniculum vulgare*). The mixture, together with a sprinkling of salt, is now heated in an inverted *saç* until most of the cereal grains have swollen and split open.[3] At this point, the mixture (*kavurmağ*) is emptied into bowls ready for immediate consumption. Any charred grains (there are often quite a few) are picked out and discarded. Dalman 1931, III, 60 also describes roasted grain (Ar. *qalije*) being prepared in the field from whole bunches of ripe ears for the benefit of reapers, neighbours and, above all, the poor.

The effect of roasting is not merely to render the grains soft and floury, but also to partially convert the starch to sweet-tasting dextrins. This conversion occurs at ca. 200° C (Tyler 1962). Roasting clearly represents the simplest and quickest way of rendering grain palatable and digestible, though today, at least, roasted grain, like the even more popular roasted chick-peas (*leblebi*), rarely provides the major meal of the day. On the other hand, *kavurmağ* is often the first food offered to guests on arrival in the homes of Turkish villagers, and serves as a snack while the daughters bake the bread that will form the centre of the meal that is to follow.

b) Flour from roasted grain (*Tarkına* and *kavut*). Pounded *kavurmağ* is often added to *yoğurt* to produce the delicious *tarkına* which is eaten fresh (contrast *tarhana*, described below under *f* and in step **46d** of Part I). For a description of equivalent products in Palestine, see Avitsur 1977, 230. That the combination of pounded, parched grain with yoghurt or buttermilk was popular well beyond the confines of the Near East is attested in Fenton 1978 for the Shetland Isles and it was regularly eaten by the present author in rural parts of Finland where it was called *virkuna*. In some parts of Turkey, however, *kavurmağ* is occasionally prepared in greater bulk, then ground in a rotary quern (*el değirmeni*) to

produce a special flour (*kavut*). This flour is usually boiled in water or milk to produce a gruel of the same name. Alternatively, *kavut* is sometimes used to produce bread, though without need of further baking (see food **i)** below).

c) *Fırık*: scorched, milk-ripe grain. In contrast to the *frikké* of Syria and Palestine (see below), the Anatolian *fırık* is prepared on only a small scale from grain at an even less advanced (milk-ripe) state of maturity. In the simplicity of its preparation it parallels *kavurmaç*, and, like *kavurmaç*, is consumed only as a snack. With *fırık*, however, the snacks are generally prepared and eaten out in the fields rather than in the home, primarily by those engaged in weeding the crops (see stage 10 in the Summer sequence above, Part I).

So far, I've seen *fırık* prepared only from naked wheats such as *T. durum* and *T. aestivum*.

a) Ears are plucked or cut (or the whole plant uprooted) when turning from green to yellow, at which stage the grains are somewhere between "milk-ripe" and "dough-ripe". (In both states the grain is still soft, but in the former it is possible to squeeze out a milky juice while in the latter it is not).

b) The ears are then laid on top of a small, open heap of straw and/or dry weeds which are then ignited. The fire quickly burns itself out leaving lightly singed ears lying among the ashes.

c) The singed ears are then picked out and broken (threshed) by rubbing them between the hands over a bowl into which falls the mixture of grains, light chaff, and rachises.

d) The chaff is next winnowed away by the *fırık*-maker simply by blowing into the bowl. Any rachises remaining with the grain are picked out and discarded along with any charred grains.

e) The half-cooked, half-ripe grain is then eaten while it is still warm. The sweet flavour and juicy texture make *fırık* very palatable, although for certain of our colleagues it proved to have dramatically purgative properties. The only equipment used today is a bowl and cigarette lighter.

Avitsur 1977 describes what appears to be an identical process in Palestine and names the product *karmel* (Heb.). He also describes an "intensive", village-based version of *karmel* production in which tied bundles of ears are "singed" by being passed back and forth over the flames and then threshed by being rubbed against an upturned riddle in a tub or similar receptacle (see his Fig. 3). It should however be noted that the term "*karmel*" is also applied to the product described below under the Arabic name of *frikké*.

Equivalent traditions appear to have existed in recent times well beyond the Near East. Thus, Gunda 1983, 151, records (albeit for Emmer - a glume-wheat) that in Hungary "the half-ripe ears are scorched, the grains rubbed out between the palms and will thus be eaten in an almost prehistoric way". For reference to foods prepared from mashed *fırık*, see product **i)** *(ii)* below.

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d) ***Frikké* (Ar.): scorched, cured, dough-ripe grain.** Unlike *fırık*, *frikke* is generally produced in bulk and, apparently, always from dough-ripe grain (contrast *fırık*, above). Today, at least, the only wheat used is, apparently, *T. durum*. For the following rough outline of the process I am very grateful to Phil Williams (pers. comm. 1982) of the Grain Research Lab., Manitoba, who is currently preparing a first-hand detailed account of *frikké* production for the forthcoming issue of *Rachis* (see bibliography). (I have not yet witnessed the process in person).

a) The crop is harvested while the grain is still dough-ripe and
b) the harvested material fired.
c) The residue is then winnowed and coarse-sieved to separate the singed ears from the mass of ash and charred pieces of straw.
d) Next, the ears are apparently threshed by rubbing bunches of them against a riddle placed over a receptacle of some kind. (Compare Avitsur's details, above).
e) The singed, threshed grain is finally "cured" by spreading it on indoor surfaces and leaving it in the dark for three days. Once thoroughly dry, the grain is stored in sacks.
f) It is cooked by boiling - as per *bulgur*, but for longer.

Frikké can be bought in most Syrian and Palestinian markets and, in our experience, requires careful hand-sorting to remove small stones before cooking. This precaution is necessary with all grain products (other than those based on sifted flour), but with *frikké*, the necessity of curing it by spreading it on floors, etc., seems to expose it to an additional risk of contamination with small stones - depending (presumably) on the curing surface used.

Avitsur 1977 also describes *frikké* production on a commercial scale in Palestinian villages south of Hebron. (Again, he applies the Hebrew name *karmel*). Precise details are not offered, though one clear difference is in the use of sledges to thresh the grain from the ears. However, this application of the term *karmel* does not cause the same degree of confusion as its application (cited above) for a product that appears (from Avitsur 1977) to be the Palestinian equivalent of the Turkish *fırık*. In the apparent absence of Arabic (or Hebrew) terminology which conveniently distinguishes the two products, we can perhaps refer to one as the "Turkish *fırık*", the other as the "Arabic *frikké*", this regardless of the common origin of the two words, as noted by Postgate 1984, 105. For Classical times, Pliny (*Hist. Nat.* xviii, 298) describes the harvesting of unripe grain, though he does not describe how it was processed or on what scale - whether as *fırık* or *frikké*.

Equivalent traditions again exist well outside the Near East. The Schwabian/Bavarian *Grünkern* is prepared and consumed in similar form (Prof. Körber-Grohne, pers. comm.), and although produced only from Spelt, Emmer and Einkorn, may, elsewhere, have been prepared from free-threshing wheats too.

e) Boiled, whole grains (from ripe ears).

(i) As with glume-wheats, whole grain that has just been boiled in the course of *bulgur* preparation is regularly consumed as a snack or as a mid-day meal by those involved in the work (see step 38, Part I). (Eaten by our British students, *T. durum* grain consumed in this form proved even more purgative than boiled grains of Emmer).

(ii) Aşure. Boiled whole grain of *T. durum*, is also used as the basis of a complex dish (*aşure*) which has particular significance in the religious calendar of the Alevi order of dervishes. Carefully cleaned whole grains can be used, but more commonly they use grains which have had their pericarps (bran) removed in stage 40 of the *bulgur* sequence as outlined in Part I for emmer wheat. They are then boiled until they are very thoroughly cooked and gelatinous, bean flour and some whole beans are added, together with honey, some sesame, broken nuts, cinnamon and, as the mixture cooks, handfuls of the fleshy seeds of pomegranates. Today, sugar is generally used in place of honey, though in the isolated region of Dersim in the S. Munzur mountains, they say they used to use pounded white mulberries as the sole sweetener in this as in all other sweet dishes. On cooling, it sets as a sweet jelly and is delicious. Intriguingly, Avitsur 1977, 231, cites the preparation of what may be a similar product on "festive and mourning occasions" amongst Christian communities in Palestine.[4]

f) *Bulgur* and *tarhana* (from free-threshing wheats). Of the free-threshing wheats only macaroni wheat (*T. durum*) is regularly used to produce *bulgur*. Bread wheat is quite unsuitable, though it can nevertheless be used to produce various forms of groats or porridge (see below).

Following additional cleaning (as in steps 38-40 in Part I), and, sometimes, grain washing deferred from step 24 (p. 8 above), production from *T. durum* grain follows precisely the same sequence as that applied to Emmer grain (see steps 41 to 47 in Part I). *Bulgur* production from *T. durum* generates the same three grades of grits as Emmer, and they are put to precisely the same uses. These include (in some villages) the production of dried balls of *tarhana* (see step 45d in Part I) which provide an invaluable means of preserving the early summer surplus of milk products, as well as of utilizing a low-grade cereal by-product. (In Sumer, the surplus of milk would presumably have climaxed in the spring). The economic advantages of domestic production of *tarhana* in even urban communities is touched on by Benedict 1974, 164, and the winter storage of *tarhana* is described by Balaman 1969, 268.

g) Crushed grain (groats), made into porridge or gruel, Tur. *lâpa*.
Many groups shortcut even the most abbreviated *bulgur*-making sequence by simply crushing (pounding) the intact grains in a mortar and boiling them in water to produce porridge which they eat with or without the addition of milk products and/or flavourings such as honey. This practice was, apparently, especially prevalent amongst groups such as the Bedouin whose mobility required them to restrict the amount of heavy stone equipment

that they carried around (see Musil 1928a & b; Hütteroth 1959). Indeed, Musil cites crushed grain (Ar. *dershishé*) as having been the principal farinaceous food of the Ruwala and other Bedouin. For equivalent foods consumed by sedentary farming groups, see Koşay and Ülkücan 1961. According to Avitsur 1977, both groats and the urban guild of groatsmakers are cited in Talmudic sources.

It should again be stressed that porridge can, if required, be produced from *bulgur* by prolonged boiling in ample water. Indeed, the principal farinaceous food of Latium seems to have been *puls* based on Emmer bulgur (see Part I, p. 141).

h) A further form of mashed wheat kernels (Tur. *Akdene*).
Balaman 1969, 268, describes the *kış hazırlıkları* (preparations for winter) in the village of Örencik as including the manufacture of *akdene*. In his list of local terms used in daily life at the village (p. 288), he defines *akdene* as *buğdayın dibekte dögülerek kabuğundan çıkarılmış hali* ("wheat grains in a state in which their bran has been removed, pounded in a mortar"). It would appear that this product uses par-boiled grain kernels taken from step 4 of the *bulgur* sequence (see fig. 1), i.e. from the equivalent of step 44 of the glume-wheat processing sequence outlined in Part I.

I have never encountered *akdene* myself, and precisely how it is finally prepared for human consumption is not clear. Nevertheless, it is yet one more grain product which may have some antiquity and be cited in early texts.

i) Foods prepared from crushed or ground grain harvested in its milk- or dough-ripe state. At least three such foods are reported in the ethnographic literature and, although not reported from the Near East, may well have been consumed there in times past.

(i) First, the Schwabian/Bavarian *Grünkernmehl* is prepared from dried, ground, 'half-ripe' grains and thence used to make the "*vorzügliche*" *Grünkernsuppe* as well as other dishes (Maurizio 1927, 141). While, in Schwabia, at least, this food was (and is) prepared only from Spelt, Emmer and Einkorn, Maurizio also quotes Treichel 1885, 216, who notes that the Kasubians used half-ripe rye (a free-threshing cereal) "... den sie am Ofen dörren und auf der Handmühle mahlen". No doubt naked wheats have sometimes been used in just the same way.

(ii) Secondly, Gunda 1983, 151, quotes Pintér 1909, 244, as observing that "Among the Polocz (Hungarian ethnic group ....) the not yet fully ripe, milky rye ears are scorched on the flame, the grains are crushed in a wooden mortar, and the pulp is baked on embers in fist-sized lumps or as cakes" (I am grateful to Mark Nesbitt for bringing the Gunda paper to my notice). Similar foods have elsewhere doubtless been prepared from naked wheats, too, especially in areas not suited to rye cultivation.

(iii) Thirdly, Maurizio (1927, 140) cites yet another food "die aus unreifem Korn bereitet wurde", namely the Polish and Bohemian *prazmo* which, under the name *prazno*, Gunda 1983, 151 describes as "a *knoedel*-like meal" i.e. dumplings of some sort.

[illegible]) Dumplings (stewed dough) from ripe grains.
[illegible]plings represent a particularly convenient way of rendering cereal flour [illegible]ible, and the many references to them by Maurizio 1927 and other auth[illegible]s suggests that, in some parts of central and northern Europe at least, [illegible]hey once represented one of the principal forms in which cereal products [illegible]re eaten. Normally, mature grain was used (contrast **i)** *(iii)* above). [illegible]hile I have not knowingly encountered dumplings in the Near East, the [illegible]ossibility of their having played a part in its earlier culinary history [illegible]annot altogether be excluded.

k) Pasta/Noodles (Tur. *makarna*)
There is little evidence relating to the origins of the system of mixing **f**lour and eggs to make a pasta-like product which could be dry-stored for **l**ater use. More certain is the fact that bread wheat is quite unsuitable **a**nd, today, only *T. durum* is used. The unsuitability of bread wheat was **a**ll too apparent from an epidemic of wife-beating in Italy in the 1960s **w**hen pasta manufacturers ran out of *T. durum* and covertly used *T. aestivum* **(**bread wheat) instead, with the result that, on cooking, the pasta **d**issolved into a glutinous mass.

The economic importance of such products lies in their providing a **m**eans of storing surplus egg-products in relatively stable form. It is **n**o coincidence, therefore, that we find Anatolian households preparing **n**oodles whenever eggs are plentiful and cheap. The economics are briefly **o**utlined by Benedict 1976, 164. Balaman 1969, 268, also cites pasta production as one of the standard preparations for winter at the village of **Ö**rencik near Kızılcahamam.

l) Stewed dough-cheese mixture (Tur. *pirohu, pirofu*).
Some villages produce another dry-storeable product by mixing wheat flour **w**ith the dry powdered form of the cheese of sheep and goats. They are **m**ixed wet and allowed to dry out in balls or lumps which are stored for later consumption as a stewed cheese-dough dish called *pirohu*. Thus, while not used to produce a soup, as *Tarhana*, it provides a very similar means of conserving surplus milk-products in a highly resistant form. Balaman 1969 describes *pirofu* production as one of the standard preparations for winter at Örencik village, and a seemingly identical product is described for the Turan area of NE Iran by Martin 1980, where it is apparently called *arisha*.

m) Unbaked bread
As mentioned under food **b)** above, the flour (*kavut*) prepared from roasted grain (*kavurmağ*) is sometimes used to prepare bread, simply by the addition of water and without need of further baking. Such flour has particularly good keeping properties and this, with the absence of any need of baking facilities, has in the past made it the preferred food of many travellers, shepherds and others without ready access to ovens. This advantage is stressed by both Musil 1928a & b and Avitsur 1977.

n) Bread (*ekmek*)
Several operations are involved in making bread, but as so much is already published on the subject, only the briefest outline is included here.

(i) Grain washing (buğday yıkamağı), drying and resacking. This step is often omitted and may, in any case, have already been undertaken at an earlier stage (see step 24 above, for details). Normally, once washed and dried, the grain intended for milling is immediately sewn into closely woven woollen sacks (sing. *buğday çuvalı*) of one *kile* (ca. 100 litres) capacity, all ready for eventual transport to the mill (if not hand-milled at home). These grain sacks are often richly ornamented, either with the pattern woven (in *kilim* style) or embroidered (*cicim* style), or with a more ornate pattern incorporated by double weaving within panels (*sumak* style). However, Koşay 1951, 14, also describes the washed and dried grain being transported to the mill stitched up inside especially large "cart-sacks" (*kağnı çuvalı*) of 400-450 litre capacity and mounted on solid-wheel carts. These are generally of dark goat-hair.

(ii) Grain measuring (buğday ölçemeği), generally by volume using a wooden *çerik, çinik* or *sinik*. Today, in communal water-mills, each measure is poured direct into the square wooden hopper which funnels the grain down into the hole in the top millstone. Clearly, the grain is measured at this point only if it is being milled outside the home. Today, at least, it is usual for the miller of a community water-mill to take 1/20 of either the grain or the resulting flour as payment for his services (see Koşay & Ülkücan 1961).

(iii) Milling (değirmende öğütmeği). The diverse range of methods and equipment for milling grain are well summarised elsewhere. For classical times, Moritz 1958 provides a remarkably thorough survey, though, as he himself stresses, much of the equipment was used only in sophisticated urban centres and is unlikely to have been found in Sumer. Certainly they appear to have been more sophisticated than those now found in the smaller villages of rural Turkey. To produce finer flour, the grist is re-milled.

(iv) Flour sifting (un elemeği). The resulting flour is sieved - firstly to remove small pieces of grit which are sometimes shed by the millstones, secondly (and sometimes incidentally) to remove all the larger flakes of bran. In present day Turkey, the flour sieves are woven from fine wire though the older villagers recall the use of sieves of woven wool. For classical times, Pliny (*Hist. Nat.* xviii, 108) reports that "Gallic provinces invented a kind of bolter (*cribrorum genera*) made of horse hair", that in Spain they "made sieves and meal sifters of flax", and in Egypt of "papyrus and rush". Moritz 1958 concludes that two different grades of flour sieve were used in sequence: the *cribrum pollinarium* and the *cribrum excussarium*. (Within this last grade he includes the *cribrum farinosum*.) Both grades were made of linen, which innovation Pliny attributes to Spain. Pollux apparently suggests that effective sieving of flour in classical times first became possible with the replacement of reed sieves by sieves woven from linen, though Moritz 1958 suggests that the finest sieve (the name of which, he notes, rarely appears in early texts) was probably used only in sophisticated urban contexts.

It must be stressed that the modern obsession with "pure", chalk-adulterated, white bread bereft of the fibre necessary in healthy diet was first adpoted by the self-styled elite of urban centres of the Roman Empire. But from Galen's frank commentary on the virtues of village breads of rural Pamphylia and Thrace, it is clear that the maladies conditioned by diets of fibreless pap were restricted to the towns.[5] Those of us working in rural areas of the Near East can be grateful that the still extant fad bequeathed by the Roman fashionables has yet to beguile the palates of the majority of Near Eastern villagers.

(v) Leavening (mayalandırma) In addition to the standard present-day practice of simply using soured dough retained from a few days previously, Pliny (*Hist. Nat.* xviii, 68-69 and 102-4) outlines a number of other leavens used in his day: *a)* Foam from the vats in which grain was being steeped in preparation for malting; *b)* millet dipped in unfermented wine (available only during wine-making season); *c)* cakes of wheat bran again dipped in unfermented white wine; *d)* barley leaven which soured quickly enough not to need dipping in wine; *e)* flour (?soured) of bitter vetch or chick-peas (*cicerculae*) used to leaven barley bread; *f)* wheat flour boiled down into a porridge and allowed to go sour.

(vi) Bread baking (ekmeğin pişirmeği) Many (but certainly not all) of the basic systems of bread baking used in Palestine are conveniently summarised and classified by Avitsur 1977. More extensive details of specific forms of baking and the equipment used are published -- for Turkey by Oral 1956 and 1957, Ongan 1958, Koşay & Ülkücan 1961, and Gökoğlu 1966; for Palestine by Wilson 1906, Dalman 1928-39, vols. 2 and 7; for some of the Bedouin by Musil 1928a & b; for some Kurdish families by Hansen 1961; for the 2-layered flat bread of north Syria, Williams & El Haramein 1982; and for the Near East in general, Lerche 1980?. A useful summary of the preparation of unleavened bread in the Near East, Europe and elsewhere is also given in Maurizio 1916. For evidence of the use in Mesopotamia already by the 3rd millennium B.C. of a range of the baking systems described by the above authors, see Crawford 1981.

o) Sprouted grain (malt) products.
These can be either roasted or air-dried prior to preparation as soup, porridge, bread or as the base for fermentation in beer production, etc. (see Postgate 1984, 106).

II: FOODS FROM BARLEY

In the Near East, most of the barley is today grown as fodder, primarily for sheep and goats. (Of the grain feeds, cattle respond better to the pulses such as bitter vetch (*Vicia ervilia*), common vetch (*Vicia sativa*) and cow vetchling (*Lathyrus sativus*).) Nevertheless, in Turkey, at least, barley is still used in small quantities as a thickener for soups and in *kavurmaç*.

As stressed in the introduction above, the 6-rowed naked barleys grown in the Near East during the neolithic have long since been replaced by the hulled equivalents - both 6- and 2-rowed. However, before these hulled barleys are prepared as food, they have at least to be hummelled (unless they are of the rare, awnless *trifurcatum* varieties); but are generally (but not always) dehulled as well. (Dehulling obviates the necessity of prior hummelling).

Hummelling is the removal of the basal bit of the awn, generally complete with the top of the lemma. It is often applied to barley intended as animal food, as well as to grain intended as food for humans. Most of the dangerously robust awn of each grain will have been broken off and fragmented during threshing, but this leaves the lowest millimetre or two protruding from the grain apex. This protruding awn base would be dangerous if ingested, as, presented as a broken end, it is well able to penetrate the flesh, especially in the most common varieties of 6-rowed barley which have particularly rigid awns.

Hummelling is generally done with a mortar and pestle (or mallet) or, in the NW European tradition, with a "hummeller" consisting of a rod with, attached to it, a transverse plate composed of a chequerboard of vertical "blades" of wood or iron. The grain is poured into a flat-bottomed trough and stamped with the hummeller. No doubt many other devices can be (and have been) used to achieve the same end. Once removed, the awn bases (generally with a piece of lemma attached) are eliminated from the grain by winnowing and/or sifting.

De-hulling (to remove lemmas and paleas, which, in the hulled barleys, are fused to the surface of the grain). Barley does not have to be de-hulled if the grain is eaten in roasted form or as raw, crushed ("rolled") grains mixed with, say, milk in the form of a muesli or cooked as porridge (see p. 4 above). For most other classes of food, however, the hulls are generally stripped off and the resulting "pearl barley" used instead. That earlier populations also preferred their barley to be peeled is implied in Pliny's comment (*Hist. Nat.* xviii, 84) "... and it appears that pottage [from Emmer] was as much unknown to Greece as pearl [=peeled] barley was to Rome". The implication is reinforced for nearby Phrygia by the recovery of a pot of barley peelings from one of Gordion's palace-quarter megara in which several steps of grain-processing appear to have been in progress when the city was attacked and burned in the early 7th century B.C. (Hillman, unpub.).

The methods of barley pearling in present-day Anatolia are precisely the same as those applied in removing the bran from par-boiled wheat grain in the third step of *bulgur* production (see step 43 in Part I), namely, they use either the heavy *seten* or else a *dibek* (mortar) together with either mallets or pestles. With barley peeling, however, the grain does not have to be boiled and dried beforehand, though my informants (e.g. at Mecitözü köyü) were careful to stress the importance of *a)* the barley grain being properly ripened and dried, *b)* sprinkling the grain with water immediately prior to pounding it in the *dibek* or rasping it in the *seten*. However, prior parching also helps, a point also noted by Hopf 1962.

The use of mallets and mortars to de-hull barley is clearly not restricted to Turkey. Under the name of "knocking stones", broad-rimmed stone mortars and wooden mallets have in recent times been used to dehusk barley as far afield as Orkney and Shetland (Fenton 1978), and Maurizio 1927 records similar practices in central and east Europe. On the other hand, Axel Steensberg, drawing on his rich memories of life on his family's farm and later as a farm-hand in Zealand, reports the following: "My father did not have a mortar and pestle; in fact, these tools were unknown in Denmark for the processing of barley (de-husking). He used the flail upon the barley until the husks were off. It required some time and patience. But in winter he had time enough." (Steensberg, pers. comm. 1984). [I am grateful to Axel Steensberg *a)* for so generously making this and so much other information available to me, and *b)* for kindly giving permission for me to quote from his letters.] Once removed (by whatever system) the hulls are eliminated by winnowing and/or sifting. If barley grain is to be de-hulled, it will not generally be hummelled.

p) Roasted barley
This sometimes forms a component of *kavurmağ* (see above, p. 10 under **a**)) but is today rarely eaten on its own. The hulls are not removed prior to roasting. Pliny (*Hist. Nat.* xviii, 74) notes that the "Italians bake it [barley] without steeping it in water" which may perhaps also refer to some sort of barley *kavurmağ*. He also refers (xviii, 73) to roasted barley being milled and used to make porridge.

q) Barley porridge
Today pearl (i.e. peeled) barley is often milled, crushed and eaten as porridge, and the practice clearly has respectable ancestry. Pliny (*Hist. Nat.* xviii, 72) claims that "the Greeks prefer it to any other grain for porridge" and that they added to it "large quantities of roasted linseed [a laxative] and coriander" [an anti-flatulant]. Perhaps the large-scale import of coriander distributed in minimum units of 17 litres by the Mycenaeans represents an earlier example of the same barley-eating tradition (see Chadwick 1976 for his translation of the Linear B tablets concerned). For Classical Greece, Moritz 1958 concludes that barley *polenta* (porridge or gruel) was prepared direct from the unmilled grain, but whether the 'milling' can be taken to imply dehusking is not clear. Pliny (xviii, 71) notes its consumption in India as well.

r) "Kneaded things" (Greek *mâza*)
Moritz 1958, 149-50 also discusses the Greek use of barley to produce "kneaded things" which, intriguingly, were not baked. He notes that "the 'kneaded things' (*mâza*) were the everyday food of the greater part of the Greek population, for as long as barley retained its importance". Sumer likewise seems to have consumed large quantities of barley, and it is clearly of interest to know if equivalent products ever formed part of their regular diet.

s) Barley dumplings (stewed dough)
It seems that flour of any cereal can be eaten as dumplings, barley included (see product j) above).

t) Barley bread (Tur. *arpa ekmeği*)
Barley bread is still widely eaten, though it appears rarely to have rivalled wheaten bread in popularity. For recent patterns of consumption and modes of preparation (especially in central and East Europe) see Maurizio 1916 and 1927. Pliny (xviii, 71) again notes its consumption in India; but for areas nearer home states (74) that "barley bread was much used in earlier days, but has been condemned by experience and is now fed to animals". He later adds (103) that barley bread was leavened by the use of the [fermented?] flour of *Vicia ervilia* (bitter vetch) and *Cicer arietinum* (chick-pea). That barley bread was regular basic fare in Palestine at the time of Jesus is suggested by St. John the Evangelist's record of the miraculous feeding of the five thousand (John 6, 9), and its more ancient use is indicated in Ezekiel 4, 12.

u) Foods from the millets
The millets should, perhaps have been included in the same section as the glume-wheats. Like the glume-wheats *a)* the grain cannot be prepared for food until the husks are removed, *b)* the husks comprise both glumes and lemmas. (For details of the de-husking of millet grain with mortars, wooden hand-mills and foot pestles, see Gunda 1983, 150 & 160-162.) Nevertheless, it must be stressed that they are quite unrelated: the millets belong to an entirely separate sub-family (the Panicoideae) of the grass mega-family (the Gramineae or Poaceae).

In present-day Turkey, millets are, to my knowledge, grown primarily *(i)* as animal feed, *(ii)* as the source of the delicious, mildly fermented drink called *boza*. This drink is characterised by its thick texture and effervescent taste, and is generally sold in winter-time. However, Prof. David Oates recalls that in the Çukurova of S. Turkey (Cilicia), he was told that cracked millet was used to make the best quality of *bulgur* (pers. comm. to the editor, to whom I am grateful for bringing it to my notice). Elsewhere, millet grain is (or was) used to prepare many of the other foods listed for wheat and barley, and for information on their range and modes of preparation the reader is referred to Maurizio 1927 and Gunda 1983. Millets are of a more tropical origin than our other Near Eastern cereals, are a summer crop (sown and harvested well after the others), require either irrigation or high water table, and are sown at low density - generally by dibbling or trickling (see Part I, step 7). Regrettably, I have never observed their processing for human food and can offer no first-hand information.

CONCLUDING COMMENTS: A NOTE OF CAUTION

The outline of operations, their products and the associated tools given in Part I and in the present paper inevitably represents a gross simplification of the broad spectrum of practical realities. For example, the rich agrarian and culinary traditions of even a country as diverse as Turkey clearly encompass only a segment of the full range of possibilities. (The geographic and temporal limits to the applicability of Near Eastern ethno-agrarian models have been discussed exhaustively elsewhere, e.g. in Hillman 1981, 130-139; 1984a, 7-11). Even with any one tradition, many adaptations are possible according to local conditions. This has been stressed by Prof. Axel Steensberg (pers. comm. 1984) who gives the following example from his early farming experiences in Denmark: ".... my father did not always use the same methods of [crop] processing strictly in each case. It depended, of course, very much on, for example, the conditions of harvesting [with respect to wetness] .... Even the treatments in the barn could vary, as well as the cleaning processes."

Nevertheless, there are eventual limits on the range of effective, convenient ways of undertaking any one task using traditional technologies, even if the tools used may look very different in different parts of the world. For example, throwing a mixture of straw, chaff and grain into the air moved by a cross-breeze is regarded by almost all cultures as one of the best ways of separating the three components. But the tools used to propel the mixture into the air often exhibit striking variations in each region. As for the *sequence* of the different operations, this appears more inviolate. For example, most of the straw must be separated from the grain *before* the latter is sieved to remove small-sized contaminants, as, otherwise, the straw would clog the sieve. So with most of the rest of the sequences outlined here and in Part I. And of course, when applying *ethnographically* based interpretive models in the analysis of archaeological/textual data, we do at least know that the models represent possibilities which are (and presumably were) agriculturally feasible. Nevertheless, we must never forget that other possibilities will often have existed for the peoples concerned.

POSTSCRIPT: Additional references

The following works came to my notice too late for their contents to be adequately cited in the present paper or in Part I. However, they clearly deserve to be better known amongst those involved in studies of early agriculture: Sigaut 1977; Lerche & Steensberg 1983; Gunda 1983; Sigaut, in press; and the collection of papers in the volume *Les Hommes et Leur Sols* (see under Sigaut 1977). Each work has an extensive bibliography.

The readership of the *Bulletin* includes archaeologists concerned with reconstructing past patterns of agrarian life from excavated remains, and it is therefore appropriate finally to cite a new and exciting study which addresses this objective in a way which parallels and extends that developed by archaeobotanists for *a)* interpreting charred remains of crops and weeds in terms of ancient agrarian practice, and *b)* identifying past func-

tions of excavated structures.[6] In her 'Agricultural equipment and agrarian social structure', the ethnoarchaeologist Valentin Roux (in press) has explored (in present-day villages) the correlations between - on the one hand - various components of agrarian social structure, and - on the other hand - the types and abundance of agricultural tools, and their patterns of distribution relative to village structures of known function. Her objective in developing her ethno-agrarian model is thus to provide archaeologists with the means of interpreting remains of tool assemblages (and the associated structures) in terms of past patterns of agrarian social structure. The recovery of information on agrarian social structure is one of the concerns of the Sumerian Agriculture Group, and Roux's work therefore represents yet another area of study with which the Group must attempt to maintain contact.

NOTES

1. There are exceptions to this greater resistance of hulled grain to transport losses. These exceptions involve the many crops of 6-rowed barley which, following introgression of 'brittle-rachis genes' from neighbouring populations of wild barley, produce ears which partly or wholly shatter at maturity. This phenomenon can be encountered in many parts of the Near East today and was doubtless even more common in the past - when wild barley was certainly more abundant than it is today.

2. It is quite possible that, in the past, grain may also have been regularly retrieved from the nests of rodents, especially in the Near East where rodent numbers and diversity are greater than in Europe. Peter Rowley-Conwy kindly brought the following to my notice: In D. Chandler's *Marlborough as a military commander* (London: Batsford, 1973), 282, Col. Sterne is apparently quoted as reporting that "During the siege of Aire [France], provisions were very scarce; but one thing gave the soldiers relief and it is almost incredible - and it was the hoards of corn which the mice laid up in the storehouses in the earth, which our men found, and came home daily loaded with corn which they got out of these hoards".

3. A *saç* is a concave sheet of metal, generally 50-60 cm. across and, with the convex side up, used for baking two of the major types of flat bread.

4. The word *aşure* derives from the Arabic *'aŭurah*, which refers first to the feast on the 10th day of Muharram, and then to a dish traditionally eaten then. In Egypt this dish is made of rice, milk and duck (see M. Hinds & S. Badawi, *Dictionary of Egyptian Arabic*, forthcoming, s.v.), but the word also refers to a "sweet pudding based on whole wheat". Similar dishes are found as funerary food in modern Greece, and in modern Iraq the dish *'aŭuriyah* is composed of a mixture including wheat, barley, lentils, green gram, oats (*hurtuman*), dried kidney beans, cow pea (*lubye*) and rice (Sabah A. Jasim, pers. comm.) [Ed.].

5. I am indebted to Dr. Stephen Mitchell for translating the relevant passages of Galen from the original Greek.

6. For the archaeobotanical methodology, see Hillman 1973b, 1981 & 1984a; Jones 1981 & 1984; and, for some complicating factors, Bottema 1984 and Miller 1984.

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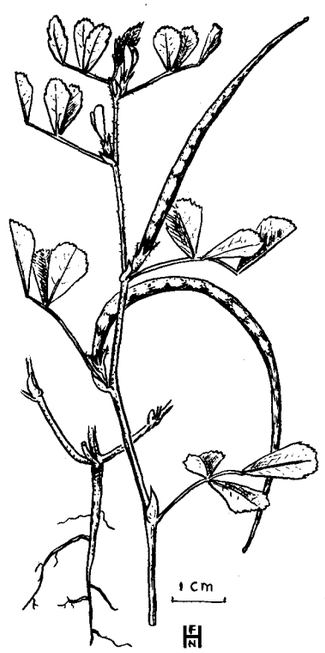
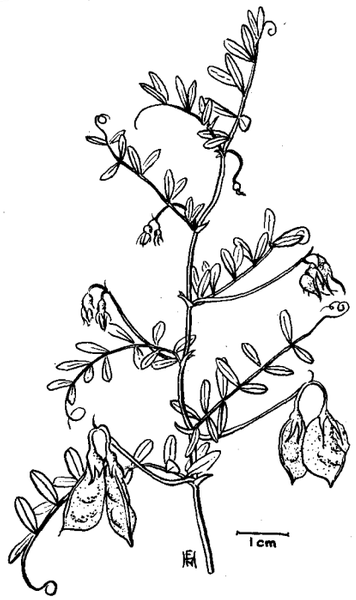
Cicer arietinum

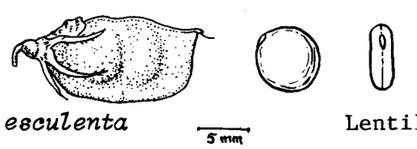
Chick-pea



Trigonella foenum-graecum

Fenugreek





Lens esculenta

Lentil

PULSES AND OIL CROP PLANTS

W. van Zeist
(Groningen)

In continuation of the lists of cereal crop plants published in a previous issue of this bulletin, leguminous crop plants and plants grown because of the oleaginous seeds are treated in the present paper. The information is again presented in a very concise manner, viz. in tabular form. For further particulars the reader is referred to the literature cited below.

It should be emphasized that not all the species listed in the tables have been demonstrated for Near Eastern archaeological sites. The discrepancy between the archaeobotanical and linguistic evidence for the use of sesame in ancient times is one of the problems we are left with. The absence of opium poppy in the Near Eastern archaeobotanical record is another curious fact.

In addition to Table 1 the following should be mentioned. A number of beans not listed in this table are reported for early historical India (150 B.C. - A.D. 200): pigeon pea (*Cajanus cajan* (L.)Millsp.), black gram (*Vigna mungo* (L.)Hepper, syn. *Phaseolus mungo* L.), green gram (*Vigna radiata* (L.)Wilczek, syn. *Phaseolus aureus* Roxb.) and hyacinth bean (*Lablab purpureus* (L.)Sweet, syn. *Dolichos lablab* L.). Various leguminous species are at present grown as green fodder, e.g. black medic (*Medicago lupulina* L.), white melilot (*Melilotus albus* Medik.), field melilot (*Melilotus officinalis* Lam.), red clover (*Trifolium pratense* L.) and white clover (*Trifolium repens* L.).

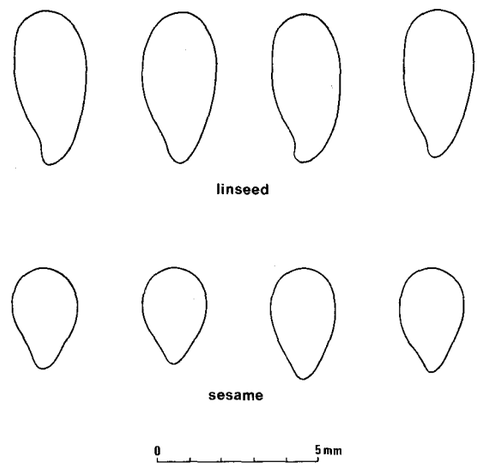


Fig. 1

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TABLE 1 : PULSES

Latin name	English, German, French, Arabic	Distribution, origin and other particulars
Lens culinaris Medik. (=*Lens esculenta* Moench)	lentil Linse lentille 'adas	Lentil is cultivated in most subtropical and warm temperate regions of the world. Small-seeded lentil (3-6 mm) was widely cultivated in ancient times; it formed part of the crop-plant assortment of the earliest farmers. The large-seeded subspecies (6-9 mm) is not known from archaeological sites. *Lens orientalis* (Boiss.) Hand.-Mazz., with a Near Eastern distribution, is at present regarded as the wild ancestor of domestic lentil. Size of *orientalis* lentils: 2.5-3.0 mm. The only distinction between wild and domestic lentil in archaeological sites is the size of the seeds. If the seeds are all less than 3 mm in diameter, it is likely that the wild lentil is represented.
ssp. *microsperma* Barul.	small-seeded lentil	
ssp. *macrosperma* Barul.	large-seeded lentil	
Pisum sativum L. ssp. *hortense* Aschers.et Graebn.	garden pea Saaterbse pois rond	Garden pea has white flowers and green to yellow spherical seeds. Field pea has pink or purple flowers; the seeds are globose or angular with one or two flat faces, brownish to grey in colour, often mottled. Peas are widely grown in regions with a cool and relatively humid climate. They were among the crop plants of the early Neolithic farmers in the Near East. In archaeological finds, spherical and angular forms occur together. *Pisum humile* Boiss. et Noë, with a Near Eastern distribution, is the probable wild ancestor of domestic pea. The latter has a smooth seed coat, whereas in wild pea the seed coat is rough. Unfortunately, in charred (archaeological) peas the seed coat is mostly no longer present.
ssp. *arvense* (L.)Poir.	field pea Felderbse pois gris bazille	
Cicer arietinum L.	chick-pea, gram Kichererbse pois-chiche hummus	Chick-pea is widely cultivated in India, the Near East, the Mediterranean area and Ethiopia since antiquity. The species requires a cool and dry climate. Small numbers of chick-peas have been recovered on Near Eastern Neolithic sites: wild or cultivated? Certainly cultivated in Bronze Age times. The ancestry of domestic chick-pea is not yet known with certainty. *Cicer reticulatum* Ladizinsky, which is found in SE Turkey, is at present regarded as the wild progenitor.
Vicia ervilia (L.)Willd. (=*Ervum ervilia* L.)	bitter vetch Linsenwicke ervilier kirsanna	At present grown only for stock feed. Archaeobotanical evidence suggests that in ancient times bitter vetch was also consumed by man. The seeds are toxic and should be soaked in water before cooking. In *Vicia ervilia*, wild forms, weedy races and cultivated varieties occur. Truly wild forms are known from Anatolia. Indications of the intentional growing of bitter vetch date back to the sixth millennium B.C.

TABLE 1 : PULSES (ctd.)

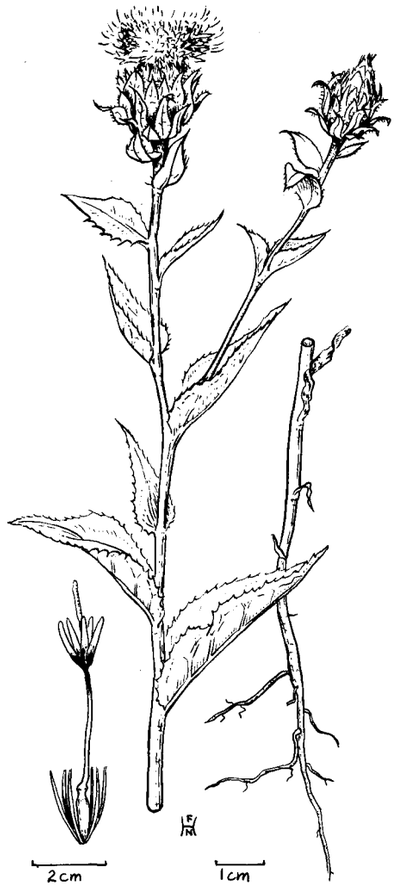
Latin name	English, German, French, Arabic	Distribution, origin and other particulars
Vicia faba L. var. *minor* Beck	tick bean Kleine Ackerbohne féverole	Only small-seeded beans (var. *minor*) are known from prehistoric and early-historical sites. The cultivation of *Vicia faba* must have started in the fourth millennium B.C. It became an important crop plant (Celtic bean) in prehistoric Europe. In the Near East, its cultivation may have been confined to the Levant. The ancestry of *Vicia faba* is still somewhat problematical. *Vicia narbonensis* L. has long been considered the wild ancestor, but now *Vicia galilea* Plitm. et Zoh., with a Near Eastern distribution, is proposed as the most likely candidate.
var. *equina* Pers.	horse bean Pferdebohne ?	
var. *major* Harz.	broad bean Puffbohne fève	
	baqilla	
Lathyrus sativus L.	grass-pea, chickling vetch Saat-Platterbse gesse cultivée hurtuman, julban	Cultivated in India and the Near East. The consumption of grass-pea seeds over a long period causes a paralytic disease known as "lathyrism". Seeds are not toxic if soaked in water for 24 hours before cooking. *Lathyrus cicera* L., with a Mediterranean-Near Eastern distribution, is regarded as the wild ancestor of domestic grass-pea. Archaeobotanical evidence for the cultivation of *Lathyrus sativus* dates back to the end of the third millennium B.C.
Lupinus albus L.	white lupin Weisse Lupine lupin blanc	Cultivated around the Mediterranean, particularly as animal fodder. Fresh seeds are poisonous to man, but boiling in water removes the bitter alkaloids. Of Near Eastern - SE European origin. No archaeobotanical evidence of lupin cultivation in the ancient Near East.
Trigonella foenum-graecum L.	fenugreek Bockshornklee fenugrec hulba	This leguminous species is cultivated as a condiment crop. The seeds contain coumarin. No records of fenugreek from Near Eastern sites.
Vicia sativa L.	common vetch Futterwicke vesce commun dharrat	Cultivated as animal fodder. *Vicia* seeds are reported from various archaeological sites in SW Asia and Europe. Only if the hilum (the scar of attachment of the seed) has been preserved, can *Vicia sativa* seeds be distinguished from other large-sized vetch seeds.
Medicago sativa L.	alfalfa, lucerne Luzerne sainfoin jatt	Grown for stock feed. *Medicago* seeds have been recovered from Near Eastern sites, but a species determination of the archaeological plant remains is still problematical.

TABLE 2 : OIL CROPS

Latin name	English, German, French, Arabic	Distribution, origin and other particulars
Sesamum indicum L. (=*Sesamum orientale* L.)	sesame Sesam sésame simsim	Cultivated in Asia (particularly China and India) and NW Africa. Origin in doubt. Reported for Chalcolithic (2250-1750 B.C.) Harappa in Indus valley. *Sesamum* pollen has been extracted from 7th mill. B.C. layers at Ali Kosh, in SW Iran. Sesame seeds have so far not been found in SW Asian archaeological sites. It is unlikely that they would have escaped attention; the seeds are large enough to be recovered, even with rather "primitive" sampling methods. Confusion with linseeds may be ruled out. Sesame seeds can easily be distinguished from linseeds (see Fig. 1).
Linum usitatissimum L.	linseed, flax Leinsamen lin kittan	One of the most ancient crop-plant species. Cultivation dates back to the late 7th mill. B.C. Frequently reported from archaeological sites in the Near East and Europe. The wild ancestor, *Linum bienne* Mill. (*Linum angustifolium* Huds.), has a Mediterranean - Near Eastern distribution. Modern fibre flax has been selected for long, unbranched stems (with few flowers); oil flax is rather much-branched, producing many flowers (and seeds).
Papaver somniferum L.	opium poppy Schlafmohn pavot noir	At present the main areas of cultivation are China, India, Turkey and the Balkans. *Papaver setigerum* DC., with a West-Mediterranean distribution, is the wild progenitor of *Papaver somniferum*. Opium poppy seeds have been recovered from a great number of prehistoric sites in Europe, starting in the 5th mill. B.C. This crop plant has not (yet) been attested for Near Eastern archaeological sites.
Brassica napus L.	rape Raps navette	At present an important oil plant, cultivated in temperate regions, particularly in Eurasia (India, China). Nothing is known about its possible cultivation in ancient times. Moreover, (charred) *Brassica napus* seeds may be difficult to distinguish from those of other *Brassica* and of *Sinapis* species. A few more *Brassica* species are grown for the oleaginous seeds. *Brassica oleracea* L. is the ancestor of all forms of cabbage. Turnip is also a *Brassica* species (*B. rapa* L.). The seeds of *Sinapis alba* L. are the source of white mustard, those of *Brassica nigra* L. of black mustard.

TABLE 2 : OIL CROPS (ctd.)

Latin name	English, German, French, Arabic	Distribution, origin and other particulars
Carthamus tinctorius L.	safflower Saflor safran bâtard qurtum	The dried florets were the source of the red dye, safflower carmin. It is now grown mainly as an oil-seed crop. Occasional finds of *Carthamus* fruits in Near Eastern archaeological sites are not yet proof of the cultivation of safflower.
Cannabis sativa L.	hemp Hanf chanvre qunnab	The plant provides fibre from the stems, oil from the seeds and narcotics from the leaves and flowers (of the female plants). *Cannabis sativa* is a native of Central Asia and is said to be of very ancient cultivation in Asia and Europe. Archaeobotanical evidence of *Cannabis* in Europe dates back to the last centuries B.C. and the species has not (yet) been recorded for the ancient Near East.



Carthamus tinctorius **Safflower**

AN INTRODUCTION TO THE LEGUMES AND OIL PLANTS OF MESOPOTAMIA

M.P. Charles
(Institute of Archaeology, University of London)

General introduction

In attempting to draw together some basic details concerning the crop husbandry of the pulses and oil plants in Mesopotamia (Iraq and Syria), it quickly became apparent that there was insufficient information available on such topics as sowing and harvesting for the area. So it was decided to include data from other, broadly similar, regions to produce a reasonably complete picture. India, China and the Middle East are the areas most commonly cited, although in a few cases it proved necessary to use data from the U.S.A., usually California, and it will be seen that these figures are much higher, in harvest yield especially, than would be expected for Mesopotamia.

Of the species included in the survey there are five which are not believed to have originated in S.W. Asia, but which I feel may have reached Mesopotamia at a fairly early date. These are: *Glycine max* (Soya bean), a native of E. Asia, *Vigna unguiculata* (Cow pea), thought to have originated in Africa but having a large centre of diversity in India, *Paseolus aureus* (Mung bean), probably from India, *Ricinus communis* (Castor oil), originating in Africa or India, and *Vicia sativa*, a native of Europe. *Prunus amygdalus*, the almond tree, which was an oil source, will be treated with the fruit trees in the next issue of the *Bulletin*; there is no record of *Lupinus albus* L. in Iraq, so it has been omitted from this article.

The pulses

The pulse as defined by Purseglove 1968 is the "dried edible seed of a cultivated legume". The plants are members of the leguminous group, one of the largest and economically most important groups of the flowering plant kingdom with almost 700 genera and 18,000 species worldwide, numbers only exceeded by the Compositae. The legumes may either be considered as a family, the Leguminosae, divided by Purseglove 1968 into three subfamilies, or as in the *Flora of Iraq*, after Hutchinson 1959, be promoted to an order, the Leguminales, with three families:

I. Caesalpiniaceae	9 genera in Iraq, 1 native
II. Mimosaceae	5 genera in Iraq, 2 native
III. Papilionaceae	46 genera in Iraq, 30 native

All the cultivated pulse crops in Mesopotamia are members of the Papilionaceae, the other two families being of comparatively little economic importance and normally restricted to the tropics.

Although we are primarily concerned here with the use of the pulses as seed crops, two other important uses should be mentioned as they have a direct bearing on the value of the pulses as crop plants, i.e. their role as: *1. Soil enriching plants* The pulses like the other leguminous plants are able to fix atmospheric nitrogen which is beneficial to the soil as it increases the nitrogen available for subsequent crops. This makes them an essential part of any crop rotation scheme, being either cut and ploughed into the soil before maturing and setting seed (i.e. as a green manure), or allowed to fruit and harvested, the stalks being used as fodder or ploughed in. They have also been used successfully in soil reclamation projects on the salinised land of Southern Iraq (Dielman 1963), and these qualities could well have been appreciated in Sumerian times.

2. Fodder plants The whole plant, with or without the seeds are generally good feed for livestock and can be grazed while growing, cut for fodder, or the stalks left after harvesting the seed as forage.

These two characteristics combined with the high protein content of the seed, which is sufficient to make up for the deficiencies of a cereal-based diet lacking meat, make the pulses a very valuable crop. Yet they seem to be of little importance in modern Iraq with the two major published surveys of Iraqi agriculture barely mentioning them. Poyck 1962 records only two species in his table of the major crop plants, *Vicia faba*, grown on 0.3% of the total winter-cropped land, and *Phaseolus aureus* on 0.2% of the total summer-cropped land. The Diyala and Middle Tigris Projects (1959) records "broad beans" as an irrigated winter crop, and pulses as summer irrigated ones. The legumes are recommended as a part of the suggested crop rotation programme for their ability to act as a soil-enriching break, producing seeds or animal feed, while at the same time replenishing rather than depleting the soil; this may be considered an improvement on allowing the land to be left fallow for a year in a more intensive agricultural regime.

The biology of the pulses

a. Chromosome number and ploidy level The cytotaxonomy of the pulses under study here is much simpler than that of cereals like the wheats and oats, being "uncomplicated by polyploidy" (Stele, in Simmonds 1976, 183, referring to the cytotaxonomy of *Vigna* sp.). All the species are diploid, usually self-pollinating plants, in which the processes of species intercrossing and chromosome multiplication have played little part. That said, the ancestral plants, the manner and location of their cultivation and, where applicable, domestication, are often less well understood than for the cereals. The movement of the species out of their native areas resulting from their widespread introduction and cultivation, combining with a diversification of forms and cultivars to confuse the sequence of events perhaps to such an extent that they can never be retraced.

b. Morphology

The fruit The most conspicuous feature shared by almost all the Leguminosae family is the fruit called a pod or legume; as defined by Guest (1966, 149) a legume "consists of a single carpel, usually opening round

the margin along both sutures into two halves". The pod of the cultivated pulses is typically oblong and narrow in shape, lacking tissue between the seeds. In other members it may be curved, bloated, spirally coiled (e.g. *Medicago* sp.) or flattened dorso-ventrally, in a few cases the fruit is in the form of a lomentum, i.e. a legume "contracted between the seeds and breaking transversely into parts when ripe" (Guest 1966, 151). The seed pod of *Prosopis farcta*, of the Mimosaceae family, is "purplish, short and fat", with a leathery texture and fleshy partitions between the seeds; it is non-dehiscent and seed dispersal is effected by grazing animals consuming the pods, the seeds passing through the gut almost undamaged.

Once the mature seeds have dried the pod dehisces, breaking into two valves, along the dorsal and ventral sutures; this process may be violent with the seeds being forcibly ejected or flicked some distance from the plant, e.g. in the Bladder Senna where the pod inflates and expels the seeds through the apex. In other cases it is the result of the valves twisting or jerking as they dry unevenly. Non-violent dehiscence of the pod means the seeds do not travel far from the parent plant but in some cases the whole pod is modified to be blown by the wind or to catch in animal hairs, etc. increasing the distance of dispersal.

In several of the cultivated pulses seed-pod dehiscence has been lost in the process of domestication, e.g. *Lens culinaris*, *Cicer arietinum* and *Vigna unguiculata*, and here it is essential that the pods be picked and seeds sown for the continuation of the crop.

The seed (Table 1) A single seed pod may contain between one and twenty (or more) seeds, each borne on a single funicle or stalk, when dried they are refered to as a "pulse". Seed size can vary considerably, the smallest of the cultivated species being that of *Vicia sativa*, 0.2-0.4(-06) cm. in diameter, the largest *Vicia faba* var. *major*, reaching 3.0 x 2.5 cm.

The seed is characterized by thick outer seed-coat or *testa* which acts both as a protective layer and as a mechanism controlling germination. This latter role is performed by preventing the uptake of water to the radicle and plumule until the testa is broken (either by physical conditions such as frost cracking or soil abrasion, or by chemical action, e.g. the gut enzymes of sheep and goats). This characteristic makes the seed, once mature, eminently storable, and it can remain edible for considerable periods of time, several years at least.

Within the testa are two large cotyledons, the seed leaves, the principal energy storing organs of the pulses which lack the large starch-rich endospermic tissue typical of the cereals (see Charles BSA 1 (1984) 21). The major food reserve substances of the cotyledons are protein, starch, and occasionally oil, e.g. *Glycine max* and *Arachis hypogaea*. The seed protein content ranges from 17 to 50%, the latter value being attained in seeds of *Glycine max*, the richest protein source in the plant kingdom. It is the high protein content of these seeds that makes them so important to the human diet, supplementing the cereals which are almost totally lacking in proteins, and supplying several aminoacids essential to human metabolism.

Sowing and harvest methods as they relate to plant morphology (Table 1)

The method of sowing is generally determined by seed size (Hillman, pers. comm.), the larger seeds being sown in rows by drilling or dibbling, the smaller ones being broadcast onto a fine seed bed and then lightly covered:

a. Large seeds over 1.0 cm. diam., *Vicia faba* (all 3 var.) and *Cicer arietinum*
b. Medium seeds, 0.5-1.0 cm. diam., e.g. *Pisum sativum, Lathyrus sativus, Glycine max, Lens culinaris*.
c. Small seeds under 0.5 cm diam., the small-seeded *Lens culinaris*, *Vicia ervilia, Phaseolus aureus, Vicia sativa* and *Vigna unguiculata*.

Seeds in the intermediate size category can be sown by either method. It has been difficult to assemble information concerning how sowing was done before the introduction of mechanized equipment in Mesopotamia, and so the references to *Lens culinaris* being sown by both drilling and broadcasting, as well as *Cicer arietinum*, may only apply to modern practice. For *Vicia faba* var. *equina* sowing by both methods is recorded for Iraq by Guest 1930 (unpublished) but this is for the agricultural station at Rustam rather than an observation of any traditional practices.

Seed bed preparation is affected by seed size, a finer tilth being recorded for the smaller-seeded plants and careful covering of the seed with just a few centimetres of soil is needed to ensure that the plant can germinate and develop successfully. The pulses are frequently sown in admixture with wheat and barley, the latter generally being cut out for fodder as the crop grows.

Crop harvesting depends on a number of factors, some of which relate to the type of pod dehiscence and plant height. They may be briefly described as:

1. End product required: when grown for the green seeds the pods are picked by hand when still immature; as a pulse the pods are picked, or the whole plant cut or uprooted; to serve as fodder the plant is cut regularly.

2. Type of pod dehiscence: if the pod is dehiscent then the harvesting must be done before the seeds are dispersed; in a crop where pod ripening is uneven this may have to be done by picking the pods as they mature.

3. Plant height and straw use: the smaller plants tend to be uprooted, for the taller plants it is usual to reap high up the stalk where the straw can be left to be grazed as forage; if the straw is required as fodder or for fuel then reaping low on the plant is the best method.

Sowing rates and harvest yields are given in Table 1: the ratio between the two ranges from approximately 7:1 to 50:1 or more.

	Sowing rate	Harvest yield	Ratio
Lathyrus sativus	39-45 kg/ha	1059-1121 kg/ha	25-27:1
V. faba var. *equina*	135-168 kg/ha	2017-2690 kg/ha	15-16:1
V. faba var. *major*	100-128 kg/ha	700-880 kg/ha	7:1

The last set of figures are averages from Poyck 1962, and compare very poorly with recorded yields of *Vicia faba* var. *major* in Britain of up to

3021 kg/ha, and an average of over 3000 kg/ha (sowing rates for these ranging from 224-447 kg/ha), but are reasonable in relation to the other yields given for wheat, barley, cotton etc. in the same report.

Seasonality (Table 1)

The legumes listed by van Zeist are all annual winter-growing plants, sown in autumn (late September to November) and harvested in late spring to early summer, from April through to June. Three of the species I have added are summer-growing annuals, *Vigna unguiculata, Phaseolus aureus* and *Glycine max*, the fourth, *V. sativa* is autumn-sown in Iraq. Sowing dates for the summer crops are March and April, the seeds being harvested in July, August and occasionally as late as September.

One factor that must be borne in mind when extrapolating from the modern agricultural system and cultivars is the possibility of changes that may have taken place in the species during several thousand years of cultivation. Ramanujan (in Simmonds 1976) describes two distinct, though interfertile cultivars of *Cicer arietinum*: (1) a *spring-grown* form: large plants with "owl-head shaped, light coloured seeds with little wrinkling of the seed coat" (2) a *winter-grown* form: "raised in the cool dry season" of India, etc., these are quick-growing, smaller plants with "small, typically wrinkled, ram-head shaped and dark coloured" seeds. The date of this development, and the possible role that either cultivar may have had in the past is not known, and the case is by no means unique: there are, for example, winter and spring-grown forms of *Vicia sativa*. We must also remember that the development of the three *Vicia faba* and two *Pisum sativum* varieties are shrouded in uncertainty; it is likely that it was the horse bean (*Vicia faba* var. *equina*) that was the principal representative of the *Faba* group and not the broad bean (*V. faba* var. *major*), which may not have been known till much later (see Renfrew, this volume, p. ***).

The ecology of the pulses

Origins and ancestral plants (Table 1)

The native areas of the ancestral pulses generally fall into the West Asian - Mediterranean Europe region and they are likely to have been present in the "fertile crescent" of the Near East, including Northern Mesopotamia. Their ancestry is not always known, but where possible the likely progenitors are listed along with the area of origin on Table 1. Three of the additional species seem to have originated in more tropical areas, yet they are not outside the regions occupied by the progenitors of species considered to have reached Mesopotamia at an early date, e.g. *Cicer arietinum*. Obviously archaeo-botanical investigation could be very important in helping to establish the early sequence of introduction and domestication.

Habitat and distribution (Table 1)

In the absence of a good archaeo-botanical record, we must be very careful when considering the species cultivated in ancient Mesopotamia, using information based on the modern distribution, habitat and characteristics of the pulses. The intervening period has seen the evolution of a number of new cultivars which may have features quite distinct from their predecessors'. There is also the possibility of minor fluctuations in the climate of the region, which may have had an appreciable impact on the agricultural system.

The overriding factors in the distribution and seasonality of the vegetation are the extreme climate and low rainfall of southern Mesopotamia, which impose certain, seemingly unchanged, restrictions on agriculture. Thus there can be no extensive agriculture (of winter or summer crops) on the alluvial plains of southern Mesopotamia without irrigation water to supplement the natural rainfall, and even with sufficient water the high spring and summer temperatures can prevent the growth of many species. To plants tolerant of these conditions, however, the regular hot sunny climate is good for successful growth, especially for the production of seeds.

In northern Mesopotamia conditions tend to be cooler, rainfall higher and above the 300 mm isohyet sufficient for winter (though not for summer) crops, and the factors of habitat and altitude become much more important than in the south, where habitat types are few.

On the basis of the information presented in Table 1, the pulses may be divided into three groups extrapolated from their distribution in Iraq:

1. Species not found in southern Mesopotamia - *Cicer arietinum* and *Vicia ervilia*.

2. Species restricted to southern Mesopotamia - *Pisum sativum* vars. *hortense* and *arvense*, *Lathyrus sativus*, *Glycine max*, *Vigna unguiculata*, *Phaseolus aureus*.

3. Species found in northern & southern Mesopotamia - *Vicia faba* (3 vars.), *Vicia sativa*.

The apparent absence of *Cicer arietinum* from southern Mesopotamia is interesting as it is commonly identified with the "large legume" found in the cuneiform texts. Purseglove 1968 describes the chick-pea as a "cold weather plant" preferring a cool dry climate with cool or cold nights. One possible substitute for *C. arietinum* is *Vicia faba* var. *equina* which has a similar sized seed, grows well in Lower Iraq, and even exhibits a degree of salt tolerance, a feature unique in the pulses on which work has been carried out, and as mentioned above, it was probably this, and not *V. faba* var. *major* that was grown in Sumerian times.

One other species that experiences problems in southern Mesopotamia, this time as a result of the hot summer wind causing the flowers to be shed before fertilization had been achieved, is *Glycine max*, though it can with careful cultivation be grown quite successfully (Guest 1930, unpublished).

[N.B.: The major source of information on the distribution of the cultivated pulses was Kew Gardens collection, from where the *Flora of Iraq*'s notes are derived. On looking through this material it was very noticeable how few examples of the *cultivated* plants there were: - 3 *Vicia faba*, 8 *Cicer arietinum*, 3 *Pisum sativum* var. *hortense* (=var. *sativum* in the *Flora of Iraq*), 9 *Lathyrus sativus* examples. This is not a reflection of their scarcity, all being commonly cultivated in Iraq, but rather of the low priority given to the collection of cultivated plants, which it is generally assumed are adequately mapped out already. This problem is accentuated by the number of these plants picked at the agricultural research stations, e.g. Abu Ghraib and Rustam, which thus do not truly represent the "natural" distribution, as they may have been experimental plants which though unsuccessful were still present and recorded.]

Uses

The uses of the leguminosae can be summarized thus:

a. Pulses - dry seeds, a good storable protein-rich food source
b. Green vegetable - the unripe pods and seeds eaten raw or as a vegetable
c. Pot herbs - the leaves and shoots of certain species
d. Forage - whole plant grazed while growing
e. Fodder - whole plant, with or without the seeds, cut and fed to animals; includes the stalks or haulms left after harvest of pulses and the straw and husks residual from threshing and winnowing
f. Cover crops - whole plant as silage or a green manure 'ploughed in'
g. Soil enriching - ability to fix nitrogen makes them very useful in crop rotation systems
h. Land reclamation - e.g. of salinized soils in southern Iraq
i. Oil-seed plants - seeds of *Glycine max* and *Arachis hypogaea* (peanut from S. America) rich in oil as well as protein

Other uses include - timber, resins, condiments, fibre, medicines, gums, tanning agents, dyes, poisons, fuel, ornamental and shade trees.

The oil plants Table 2

The major oil seed plants of Mesopotamia form a diverse group, with as many families represented as there are species. Though they are mostly annual herbs, two, *Olea europaea* and *Prunus amygdalus*, are trees, and a third, *Ricinus communis*, is a short-lived perennial, capable to growing to 7 metres. The annual herbs divide equally into winter and summer crops:

a. winter crops - *Linum usitatissimum*, *Papaver somniferum*, *Brassica napus* and *Carthamus tinctorius*.

b. summer crops - *Sesamum indicum*, *Cannabis sativa*, *Ricinus communis* and *Glycine max*.

The olive (*Olea europaea*) fruits in late summer/autumn, and the almond (*Prunus amygdalus*) in spring/early summer.

All plants contain some oil, usually as a form of energy storage. It is usually distributed throughout the plant and used as required by the various tissues. Occasionally, however, it is concentrated in a storage organ such as a root tuber or the seed; in the latter it acts as a high-yielding energy store utilised when the seed germinates. The climate of Mesopotamia is well suited to the production of high seed oil yield, with its warm spring and hot, dry summer months, a high number of sunshine hours often being essential for successful seed development. Guest (1930) recommended that the area of *Linum usitatissimum, Brasica napus, Ricinus communis* and *Sesamum indicum* cultivation should be increased significantly in Iraq, and as these are much more profitable than cereal crops it is perhaps surprising that this has never been done. For a few species the extreme temperatures and the hot burning winds of summer can prevent seed-setting , e.g. in *Glycine max* and *Papaver somniferum*, but for the majority, given sufficient irrigation water, conditions would seem to warrant a greater area of land than is presently devoted to oil plants.

Examination of the two principal reports on the economy of Iraq shows that, as for the pulses, there is little mention made of the oil seed crops, Poyck recording that 1.2% of the total farmland cultivated in the summer is under *Sesamum indicum* (1962, 39). The only other oil plant to be recorded is *Linum usitatissimum*. One possible reason for the apparent under-cultivation of these plants may be the lack of suitable marketing routes for the produce.

The biology of the oil plants

a. Chromosome number and ploidy level
There is little polyploidy, *Ricinus communis* has triploid and tetraploid forms, and there are tetraploid forms of *Papaver somniferum*. [There are two subspecies of poppy, *P. somniferum* ssp. *somniferum* - the Opium poppy, grown for opium, and *P. somniferum* ssp. *hortense*, which is grown for its oil seed]. The various *Brassica* species are listed on Table 5.

b. Morphology
The oil plants of Mesopotamia share few common features outside the possession of oil-rich tissue, usually in the seed but in the case of the olive the fleshy part of the fruit. In the brief descriptions below I have tried to find features that may be useful in the identification of plants from their descriptions in cuneiform texts.

The fruit
The five types of fruit are:

i. a capsule - *Sesamum indicum, Linum usitatissimum, Papaver somniferum* and *Ricinus communis*.

ii. a pod - *Glycine max*.

iii. a fruit - *Olea europaea* and *Prunus amygdalus*.

iv. a siliqua - *Brassica napus*.

v. an achene - *Cannabis sativa* and *Carthamus tinctorius*.

Fruit dehiscence character varies not only between species and within species (domestic and wild forms), but also between domestic cultivars, as human selection can push them towards non-dehiscence as an aid to harvesting. The two predominantly dehiscent species are *P. somniferum* (the oil-seed subspecies) and *Glycine max*; in *Prunus amygdalus* dehiscence refers to the fruit-flesh splitting at maturity; seed dispersal is not effected until considerably later.

Both dehiscence and non-dehiscence can have good and bad points: dehiscent cultivars of *Sesamum indicum* must be cut between seed maturity and the onset of seed dispersal, but, once collected, threshing of the capsules is unnecessary, the plants being instead hung on racks above mats or cloth to collect the seed as it falls. When harvesting the non-dehiscent cultivar precision in the timing is not so essential, but the subsequent threshing, winnowing and sieving processes required to give clean seeds are much more time-consuming. As the capsules of *Ricinus communis* may discharge their seeds violently, they are spread on the ground or on a mat after harvesting to restrict seed loss, and after a week or so, when the majority of the seeds have been dispersed, the capsules are pounded to reduce any residual ones. Threshing is essential for *Linum usitatissimum, Carthamus tinctorius* and *Cannabis sativa*.

It can be very difficult to establish with any certainty at what stage in a plant's evolution non-dehiscent cultivars were successfully selected for, and so at present we can only conjecture as to whether the species cultivated in Sumerian times exhibited seed dehiscence or not.

The seed
Seed size ranges from ca. 0.1 cm. diameter in *Brassica napus* to that of *Prunus amygdalus* which is up to 2.0 cm. in length and 1.5 cms. broad.

Sowing practice and harvest method

The small-seeded *Linum usitatissimum* is typically broadcast onto a seed-bed with a fine tilth, and then lightly covered. This is also true for the majority of reports concerning the sowing of *Sesamum indicum*, but there is a record suggesting that it may not be so particular in its requirements: "an excellent crop of sesame was recently seen on an estate near Suwairah where the seed had merely been scattered among barley stubble without any further cultivation" (Guest 1930).

Another small-seeded crop, *Papaver somniferum* is sown in rows approximately 70 cms apart. *Carthamus tinctorius* and *Cannabis sativa* may be broadcast or sown in rows by drilling (previously dibbled), the former is a

winter sown crop and is sometimes grown in an admixture with wheat and barley, when it is broadcast sown.

Harvesting is by:

a. cutting or reaping - *Sesamum indicum, Linum usitatissimum, Ricinus communis* and *Glycine max*.

b. pulling or uprooting (also known as plucking) - *Carthamus tinctorius* and *Glycine max*.

c. picking (of fruit) - *Olea europaea* and *Prunus amygdalus*.

(the capsules of *Ricinus communis* are cut, rather than the whole plant, and this may be considered as coming within the last category).

Use of the straw seems restricted to the burning of *Sesamum indicum* stalks for fuel (the ash is considered a good fertilizer), whilst that of some *Brassica* species and *Glycine max* are reasonable fodder or forage crops. Ricin, a toxic substance present in seeds and vegetative parts of *Ricinus communis*, means the straw must not be fed to livestock.

Sowing rates and harvest yields

Sowing rates for the oil-plants tend to be low compared with those for the cereals, a reflection of growth form, i.e. plants far apart, much branched, giving a high seed yield per plant; with higher sowing rates the plants grow taller, are less branched and consequently have a lower seed yield (cf. flax and linseed forms of *Linum usitatissimum*). Rates from Iraq are equivalent to those from other similar areas.

Yield figures, where available for Mesopotamia, are low, only those for *Ricinus communis* comparing favourably with other countries. It is difficult to estimate the yield potential of Mesopotamia in the past from these modern figures, remembering the continuing soil fertility depletion and the worsening salt problem.

Seasonality

a. The winter crops These, *Linum usitatissimum, Papaver somniferum, Brassica napus* and *Carthamus tinctorius*, receive no mention in either agricultural survey, and it seems that their cultivation takes place locally on a small scale. Guest (1930a) in an article on linseed cultivation gives us a very detailed account of this species, serving to emphasise the lack of published material on other species. He recommends that sowing be done in October, the yield being halved if sown in December, and reduced to one quarter of the autumn crop's yield if planted in the spring. [Compare the observation that flax as grown in Britain is a non-frost-hardy plant which must be sown in the spring (Gill & Vear 1980).]

b. The summer crops, Sesamum indicum, Cannabis sativa, Ricinus communis and *Glycine max*, can only be grown with irrigation, whether in northern or

southern Mesopotamia, although *Sesamum indicum* and *Glycine max* are comparatively drought-tolerant. Only small areas of land are cultivated in the summer, water being in short supply, and to warrant its planting the crop must be fairly certain of growing successfully and of the produce being a saleable commodity. Only *Sesamum indicum* seems to be sown on fields where cereal crops have been grown that winter and harvested, as well as on winter fallow land, the rest being sown in the late spring on fallow land, usually in April. *Cannabis sativa* may be sown as late as June and is not harvested until November or December. (Among the legumes, *Phaseolus aureus* is sown after a winter crop of wheat or barley).

The ecology of the oil-plants

Origins & ancestral plants (Table 2)

From the modern distribution of the oil-plants and, where known, their wild ancestors, it seems that the majority of those concerned here had their origins in and around the Near Eastern and Mediterranean centres. The exceptions are *Cannabis sativa* and *Prunus amygdalus* - in Central Asia, *Glycine max* - East Asia, and *Ricinus communis* - India/Africa, all of which could have arrived in Mesopotamia quite early on. The discovery of a wild sesame in India (Bedigian, this volume), previously thought to be limited to tropical Africa in its natural distribution, emphasizes that our knowledge of the natural distribution and evolution of the major crop plants is not without its gaps.

Habitat & distribution (Table 2)

a. plants apparently restricted to southern Iraq - *Linum usitatissimum, Papaver somniferum, Brassica napus, Ricinus communis, Cannabis sativa* and *Glycine max*.

b. plants restricted to southern Mesopotamia - although grown in southern Mesopotamia *Prunus amygdalus* is chiefly ornamental there, its fruit production being greatly reduced.

c. plants of both northern and southern Mesopotamia - *Sesamum indicum* and *Olea europaea*.

The presence of *Ricinus communis, Cannabis sativa* and *Glycine max* seems to be the result of experimental work carried out at the Agricultural Stations of Rustam and Abu Ghraib. Guest (1930) in an unpublished report on the work conducted at Rustam prior to his arrival, states that the cultivation of *Glycine max* and *Carthamus tinctorius* had proved unsuccessful and that these species could not be recommended for Southern Iraq.

Salt tolerance measurements are not available for many of the oil-plants; *Sesamum indicum* has a low tolerance and requires water with a low salt content, otherwise it is susceptible to disease, while *Linum usitatissimum* has moderate salt tolerance.

Frost can adversely affect *Olea europaea*, temperatures of less than 2° C can damage the fruit and below -9° C the tree. *Ricinus communis* is also susceptible to frost injury.

Oil types Table 3

Fats and oils are simply terms applied to the same chemical, based on its appearance at room temperature (ca. 25° C); a fat heated to its melting-point becomes an oil. Oils normally start to decompose at temperatures above 300° C. There are two types of oil of economic importance:

1. *The fixed oils* - greasy, non-distillable substances, non-volatile and obtained from oil-rich seeds. They are used for cooking, illumination, soapmaking, etc. (see section on uses below).

2. *The essential oils* - non-greasy, volatile, often strongly aromatic. These are generally present, in low concentrations, in the vegetative parts of the plant; there are small amounts of pungent, volatile essential oils in the seeds of certain *Brassica* sp. (Table 5). Their uses tend to be restricted to the fields of medicine and cosmetics, though some are food flavourings.

We are here concerned only with the fixed oils. The highest quality oils are sesame and safflower, two semi-drying oils with a large range of uses from food oils to soaps (see Table 3). In both cases the principal oils contained are the same, i.e. Oleic, Linoleic and Palmitic. Olive and hemp oil are at the other end of the quality spectrum with consequently fewer potential uses.

One of the most important properties of an oil is its drying, this reflects the level of saturation and is measured by its potential of iodine uptake (which is equal to air uptake):

a. *drying oils* - unsaturated, high 'iodine values' over 150; suitable for paints and varnishes - linseed.
b. *semi-drying oils* - iodine values 100-150; cooking and salad oils, soaps and as paints and varnishes - sesame, poppy, rape or colza, safflower and soya oils.
c. *non-drying oils* - fairly saturated, low iodine value below 100; salad oils, vehicles for medicines and perfumes, occasionally as illuminants - olive, castor and almond. Prone to rancidity.

Soya oil can be converted from a non-drying to a drying oil by dehydration.

Oil extraction Figs. la & b

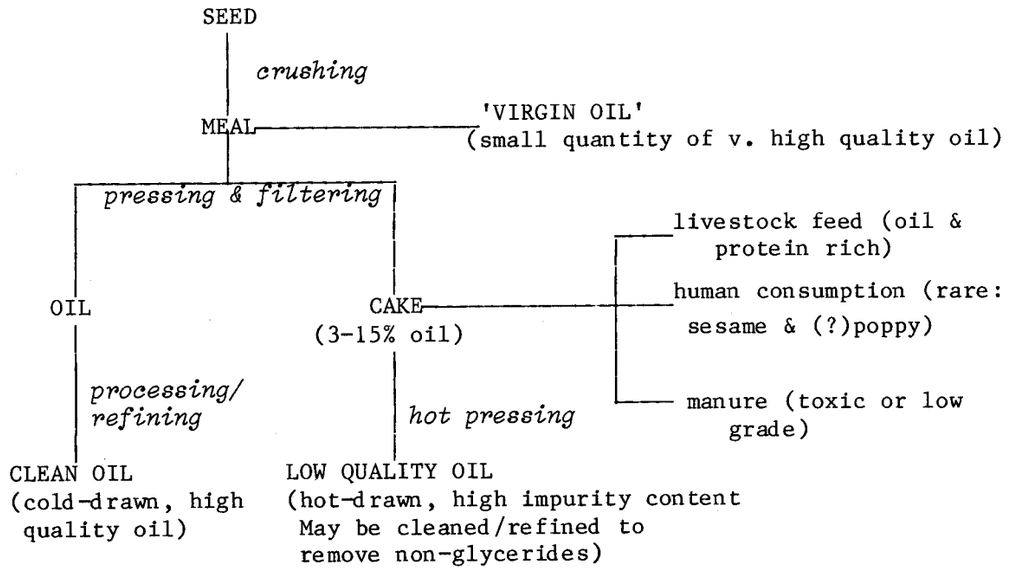
There are two basic methods of oil extraction, rendering and pressing. Which is used depends on how the oil is stored by the plant.

1. Rendering Suitable only when the oil is stored in the fleshy part of the fruit rather than the seed, e.g. in *Olea europaea*, whose fruit is picked in winter after it has turned black, indicating maximum oil content. The fruit is heaped into piles on cloth and left in the sun, and the exuded oil is collected on the cloth, which can then be "washed out" to extract the oil. (Olives are also pressed).

2. *Pressing* *either cold or hot.*

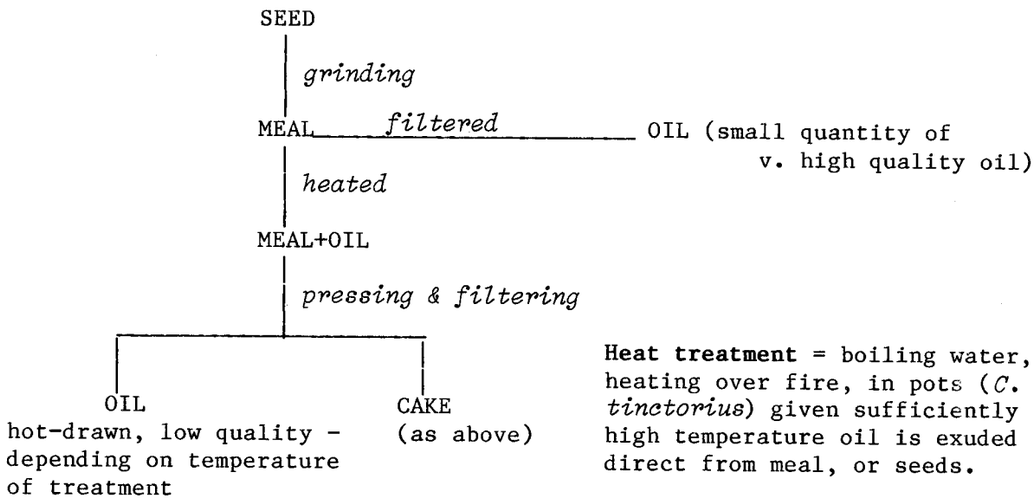
a. Cold pressing (Fig. la): The seeds are first broken up by pounding, milling or grinding to produce an unextracted *meal*. This is then pressed, the expressed oil being filtered off leaving the *cake* of crushed husks and seed kernels. Filtering is through a cloth or fine mesh sieve. The residual cake is still oil-rich (3-15%) and may be further processed by another cold pressing or instead a hot pressing treatment is applied. Alternatively it can be fed to livestock, being rich in protein and a valuable feed, or indeed, in the case of sesame, to humans. When containing a toxin or of poor quality it is used as a fertiliser.

Fig. la. Cold pressing sequence



b. Hot pressing (Fig. 1b): This can be applied to either the unextracted meal or, as mentioned above, to meal already cold-pressed. Hot pressing is much more efficient than cold pressing, giving an increased yield, but with a concomitant increase in impurities, giving the oil a much more pronounced colour. The oil thus produced is refined according to intended use.

Fig. 1b. Hot pressing sequence


SEED
grinding
MEAL
filtered
OIL (small quantity of v. high quality oil)
heated
MEAL+OIL
pressing & filtering
OIL
hot-drawn, low quality - depending on temperature of treatment
CAKE
(as above)
Heat treatment = boiling water, heating over fire, in pots (C. tinctorius) given sufficiently high temperature oil is exuded direct from meal, or seeds.

The process of extracting hot-drawn oil from *Carthamus tinctorius*, which yields a thick, black viscous material used for waterproofing, is the only one described in any detail for Iraq, and it is worth outlining the procedures here (after Chakravarty 1976):

1. seeds placed in an earthen pot inverted over similar pot buried in the earth. A sieve or perforated plate over mouth of first pot prevents seeds falling out.

2. upper pot is heated.

3. exuded oil drips into lower pot. After 2 hours at 300° C the oil produced is poured into cold water, forming a thick black gelatinous mass, suitable as an adhesive for glass and ornamental stones.

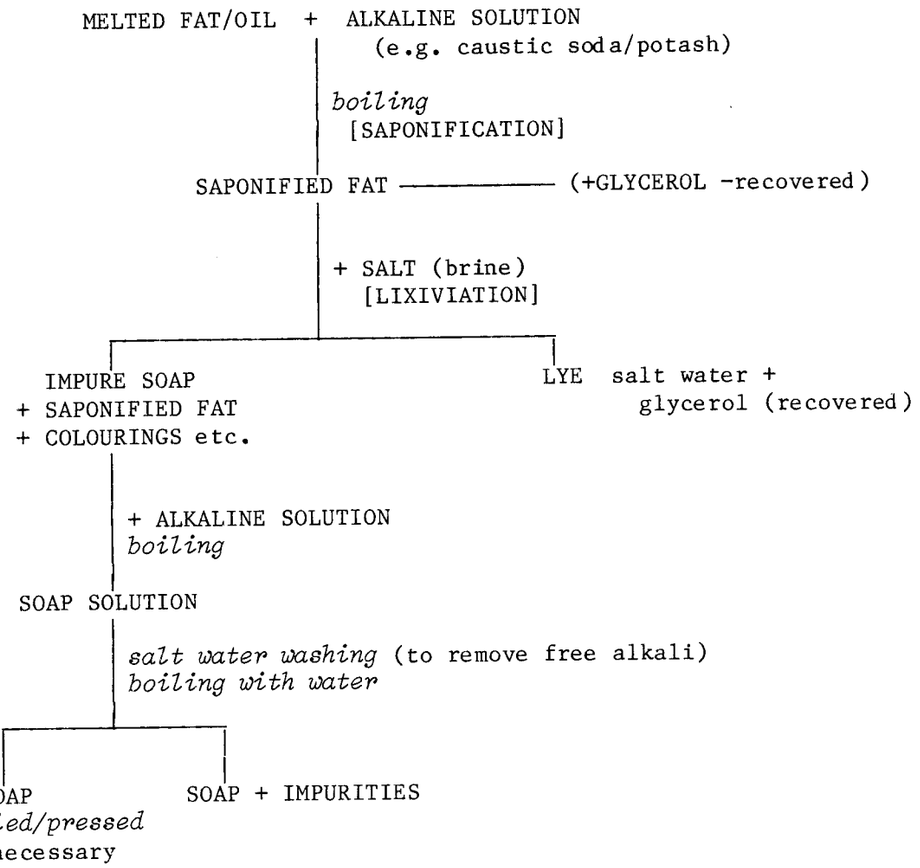
After 2½ hours at 307° C the hot-drawn oil described above is generated. An oil yield of 20-38% is recorded by Chakravarty for *Carthamus tinctorius*, presumably of total dry seed weight, though this is not specified.

The seeds of *Ricinus communis* contain a highly toxic substance, ricin, and to ensure that it is left in the meal after the oil is extracted the process must be done carefully. Similarly in *Linum usitatissimum* prussic acid (hydrogen cyanide) can be generated if the cyanogenetic glucoside in the seeds breaks down, and to avoid this boiling water should be used in the oil preparation. For the extraction of oil from sesame, see the passage quoted by Bedigian, p. 160 below.

Oil storage

Providing the oil is stored correctly, in a reasonably cool place out of direct sunlight in sealed containers, it will keep for fairly long periods (several months at least). When exposed to air the drying oils take up air and harden to a film or coating. Semi-drying oils thicken and eventually harden, at a rate determined by their iodine value and how thinly spread they are. Non-drying oils rancify as the glycerides break down (by hydrolysis) into glycerol and fatty acids.

Fig. 1c. Soap making



Oil uses

1. *Edible food oil*, e.g. as a salad oil - olive and sesame

2. *Cooking oil*, depends on response to high temperatures - safflower and sesame. Bread and cakes may be coated prior to baking.

3. *Paints & varnishes* (protective coatings), drying and semi-drying oils with high iodine values - linseed, poppy & safflower.

4. *Illuminant* - hemp and rape.

5. *Soap-making* or for fulling - most oils suitable to some extent (Fig. 1c).

6. *Perfumery* (cosmetics), as medium for scents etc. - sesame & almond, also for anointing.

7. *Medicine*, either as a medium or vehicle of application, or as a remedy - castor oil as purgative, linseed for suppurations.

8. *Leather softening/dressing* and as an aid to weaving.

9. *Other uses* - lubricant, vehicle for various chemicals, resins and water-proofing.

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TABLES 1 TO 5

Table 1 : Distribution, ecology & agronomic details of the legumes

Table 2 : Distribution, ecology & agronomic details of the oil plants

Table 3 : Characteristics of the different oils

Table 4 : Oil plant fruits

Table 5 : Brassicas

The tables are intended to give the characteristics of the plants as may be relevant to their identification in the cuneiform sources; they are by no means complete, and I would be grateful for any more information concerning their cultivation in Mesopotamia.

Table 1 : Distribution, ecology & agronomic details of the legumes

LATIN NAME	ORIGINS & possible ancestors	DISTRIBUTION in Iraq				ECOLOGY altitude limits in metres	tolerance to:-			
		forest	steppe	alluvial plain	other		water logging	drought	salt	frost
Lens culinaris	Eurasia *L. orientalis*	occ	rare	v. rare		(0-)500 -1450	pr	med		
Pisum sativum	Near East *P. humile*			prs		<ca.50	pr			
Cicer arietinum	Tropical Asia	occ	moist occ			800-1300 (-1900)	pr	v. gd		
Vicia ervilia	Eurasia?	occ				800-1100				
Vicia faba	Mediterranean /Near East *V. pliniana*	occ	occ	com		0-250 (-1000)				
Lathyrus sativus	Europe & SW Asia cultiv. wild plant			com		<100	med-gd	gd		
Glycine max	East Asia *G. soja*			prs		<50		gd		med
Vigna unguiculata	Tropical Africa			com		<ca. 50		gd -med		
Phaseolus aureus	India *P. radiatus*			prs		<50 (or more?)	pr	gd		
Vicia sativa	Europe cultiv. wild plant	prs	prs	prs		<1300				
Trigonella foenum-graecum	Eurasia	lower occ		occ		<900				

com = common
occ = occasional
prs = present

gd = good
med = medium
pr = poor

Table 1 (ctd.)

SOWING seed size in cms.	SOWING method & rate (kg/hectare)	SOWING time	FLOWER & FRUIT	HARVEST DETAILS pod dehisc	pod non-dehisc	method uprooting	method cutting	method picking	method other	yield (kg/hectare)
sm.0.3-0.6; lg. 0.6-0.9	brd. & dr. 60 [56-135 Turkey#]	Feb	Apr-Jun		N	+				1000 [400-1680*]
0.5-0.8	dr. [67-112 fr. 200-335 dry*]	?aut		D			+			[2508 fresh; 2240 dry*]
ca. 0.5-1.2	brd. & dr. [34-45 India* 30 Turkey#]	aut	May-Jun (-Jul)		N	+	+			[450-1800 India*]
ca. 0.35	brd. [70 Turkey#]	?aut	Apr-Jun	D		?	?			[700 Turkey#]
L. ca.1.5 3.0x2.5 L. ca.1.0	brd. & dr. 90-155, ca.56 mix w. cereal	mid-Oct	Feb-Apr		N	+			+	(700-) 1120-2240
0.6-0.7	brd. [40-45*]	?aut	Mar-Apr	D		?	?			
1.0x0.8	dr. 45-67 [39-50 E.Asia*]	Mar-Apr	fl Jun-Jul; fr Jul-Aug	D		+	+			[605-2400 Java, USA*]
0.4-0.6 x 0.2-0.4	brd. & dr. [15-30 T.Africa & USA*]	?spr	Jun-Oct		N	+			+	[450-672 Trop. Africa*, 1000-2800 USA*]
0.4 x 0.3	brd.(?) [95-180 Turkey#,GB]	(May-) June-July	(Aug-) Sept							[1200-7531 Turkey#, GB]
0.2-0.6	brd.		Mar-May (-Jun)	D		?				
0.3-0.5 x 0.2-0.3		15-25 Oct	fl Mar-Apr; fr Apr-May							

brd. = broadcast
dr. = drilled

fl = flowering period
fr = fruiting period

*=J.W. Purseglove
#=G.C. Hillman

L.= length

aut = autumn
spr = spring

[ ] = figures from outside Iraq
( ) figures for crop sown with cereals

Table 2 : Distribution, ecology & agronomic details of the oil plants

LATIN NAME	ORIGINS & possible ancestors	DISTRIBUTION in Iraq				ECOLOGY altitude limits in metres	tolerance to:-			
		forest	steppe	alluvial plain	other		water-logging	drought	salt	frost
Sesamum indicum	Tropical Africa India	prs	prs	prs		<950	pr	med	pr	
Linum usitatissimum	S.W. Asia *Linum angustifolium*			prs		<50			med	p (?
Papaver somniferum	S.W. Asia (? Medit.) *P. setigerum*			prs		<50	pr			
Brassica napus	Mediterranean			prs		<50				
Carthamus tinctorius	S.W. Asia (?Afro-Asia) *V. pliniana*			prs exp		<?50	pr	med		
Cannabis sativa	Central Asia			rare exp		<35				
Olea europaea	Mediterranean (?West Asia)			occ		<1200				p
Ricinus communis	?India/Africa			prs			pr			p
Prunus amygdalus	Central Asia *Prunus* sp., common genus ancestor		prs			(0-) 700-1800				

exp = grown experimentally
occ = occasional
prs = present

med = medium
pr = poor

Table 2 (ctd.)

SOWING			FLOWER & FRUIT	HARVEST DETAILS					
seed size in cms.	method & rate (kg/hectare)	time		pod dehisc	pod not dehisc	method uprooting	method cutting	method picking	method other	yield (kg/hectare)
0.3x0.15	brd. & dr. 8-12 [5.6 tropics*]	*early* Feb-Mar *late* Apr-Jul	Sept-Oct	D	N	+	[+]			252-600
0.4-0.6 x 0.2-0.3	brd. & dr. 33 rec. Iraq 11.2-38.1	Oct	fl Feb-Mar(-Apr) fr May	(D) occ	N		+			897-2129
0.1-0.05	dr.	Autumn	March (-Jul)	D		?				ca. 1000
ca. 0.1	? 4.5-5.5 (for other *Br.*sp.)		?	?		?				878-1380 (for *Br.* sp.)
0.8x0.4	brd. & dr. 20-32 (8-16 mix w. cereal		n/a		N	+				400-600
0.25-0.4 x 0.2-0.25	brd. & dr. 33-67 for seed	(Jun-) Jul	Nov-Dec		N		+			1350-1680
2.0-3.0 x 0.7-1.5	dr. ca. 2-3 m between trees		fl May-Jun; fr Jul-Oct		N			+		30-70 kg. per tree
1.5 x 0.6-0.8	dr. 11.2-16.8	April		D	N		+			895-2240 [560-1000 India*]
1.5-2.0 x 1.0x1.5	dr. lower densities 5-10mm apart		fl Mar-Apr; fr May-Jun	D		+				n/a

brd. = broadcast
dr. = drilled

fl = flowering period
fr = fruiting period

*=J.W. Purseglove

[ ] figures from outside Iraq

Table 3 : Characteristics of the different oils

Oil name	Oil type & iodine value	Oil % cont. of dry seed	Principal oils contained	Extraction method	Uses: Food: Salad oil	Food: Cooking	Paint	Varnish	Illuminant	Soap	Perfumery/anointing	Medic.: Medium/vehicle	Medic.: Remedy
Sesame	semi drying 103-118	45-55	O L P	Cold	+	+	(+)		+	+	+	+	
Linseed	175-205	35-40	L O Ln	Cold	+		+	+					+
Poppy	semi drying 123-143	ca.50	L O		+		+			+			
Rape	semi drying 94-102	42-43	E O L		+	+			+				
Safflower	semi drying 130-150	30-40	L O P	Hot/Cold	+	+	+	+		+			+
Hemp	drying	32						+		+			
Olive	non-dr. 75-95	16-28	O P L	Rendered	+	(+)			+	(+)	(+)		
Castor	non-dr. 80-90	40-55	R O L				+	+					+
Soya	semi drying 125-140	13.5-24.2	L O P		+		+			+		(+)	
Almond	non-dr. 93-100				+							(+)	

O = Oleic
L = Linoleic
P = Palmitic
E = Erucic
Ln = Linolenic

Table 4 : Oil plant fruits

Name	Fruit type	Size	Dehiscence
S. indicum	capsule	7.0 x 2.0	dehiscent & non-deh.
L. usitatissimum	capsule	1.0 x 0.75	indehiscent
P. somniferum	capsule	2.0-6.0 diam.	dehisc. (non-deh. cvs)
B. napus	siliqua	5.0-11.0 long	? dehisc.
C. tinctorius	achene	ca.1.0 x 0.4-0.5	non-shattering
C. sativa	achene	0.5-0.6 x 0.4	non-shattering
O. europaea	drupe	1.3-5.0 x 0.6-2.0	non-dehiscent
R. communis	capsule		some cvs deh., most non-dehiscent
G. max	pod	2.5-8.0 x 0.8-1.5	dehiscent
P. amygdalus	fruit	3.0-4.0 x 2.0-2.5	splits at maturity

cvs = cultivars

Table 5 : Brassicas

LATIN NAME	ENGLISH & ARABIC NAMES	AREA OF ORIGIN	OIL TYPE & % OF DRY SEED	COMMENTS
Brassica campestris L. ssp. *sarson* 2n=20 self-sterile	Field mustard		fixed oil	Flowers yellow. Fruit siliqua 4-8 x0.2-0.3 cm. Annual,50-80 cm tall. Cooking oil. Sowing rate: 4.5-5.5 kg/ha.; yield 878-1380 kg/ha.
Brassica juncea (L.) Czern & Cross ssp. *sereptana* 2n=36 self-fertile	Indian mustard	(?)India or Near East	30-38% fixed oil + a volatile oil	Flowers yellow. Siliqua 3-5.5x0.2-0.3 cm. Annual,30-80 cm tall. Cooking oil.
Brassica nigra (L.) Koch 2n=16 self-sterile	Black mustard KHARDAL	Eurasia	28% fixed oil +a small % of volatile oil (1%)	Flowers yellow. Siliqua 1-2x0.15-0.2 cm. Oil used in medicine, soap-making, as a preparation for many cooked/pickled foods.
Sinapis alba L. 2n=24 self-sterile	White mustard	Mediter-ranean	30% fixed oil	Flowers yellow. Silicule 2.5-4.0 cm long. Annual, 25-100 cm. Oil ground with *B. nigra* for table mustard.
Brassica tournefortii	Wild turnip	Near East (?)	30.7% fixed oil	Oil similar to mustard oil.

FINDS OF SESAME AND LINSEED IN ANCIENT IRAQ

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The most frequently found oil-bearing seeds from ancient Iraq belong to cultivated flax, but the most common description on the cuneiform tablets refers to *šamaššammu*, usually translated as "sesame". Could there be an error in the translation or is it possible that sesame seeds have been under-represented in the archaeological record? This is the main hub of the discussion. My main purpose here is to draw together the evidence for the cultivation of both species in this area in ancient times.

Flax, *Linum usitatissimum* L., appears to have been domesticated from the wild Kurdish pale flax, *Linum bienne* Mill. (formerly known as *L. angustifolium* Huds.) in the foothill region north and east of the Tigris-Euphrates plain, where it still grows wild today at altitudes of 1,800-3,000 feet (600-1,000 m) above sea level. It appears to have been domesticated shortly after 6,000 B.C. The following finds are recorded in the literature:

Site	Date	Preservation	Seed measurements in mm.
Nimrud	*ca.* 600 B.C.	Carbonized	L. 4.41 (3.66-5.31) [50 seeds]
			B. 2.29 (1.83-2.75) "
Khafajah B	Old Bab.	Chalk replica	L. 4.76; B. 2.75
Khafajah A	'Ubaid	Carbonized	(no measurements)
Ur	'Ubaid	Seed impressions	L. 4.21; B. 2.20
			L. 4.39; B. 2.56
			L. 4.39; B. 2.38
Arpachiyah	Halaf	Carbonized	L. 3.84; B. 1.83
Choga Mami	Samarran	Carbonized	"largest on record; no measurements"
T. es Sawwan	5,800 B.C.	Carbonized	L. 4.0; B. 1.83

(**Note:** It should be remembered that when comparing carbonized seed measurements with those of impressions and chalk replicas, a shrinkage in length of about 13% should be taken into account).

In Iraq today flax varieties are preferred which develop several stems and a strong root. The seeds are sown in late October and irrigated during dry spells. The harvest takes place at the beginning of May, before the scorching summer heat can cause emergency ripening which would threaten the quality of the crop. In Iraq the crop is cut at harvest, not pulled as in Egypt (Guest 1930). In areas of limited rainfall it has been shown that the oil-seed varieties do better than those grown for their linen fibres: fair yields can be obtained with an annual rainfall of 300-350 mm.

For successful storage the seeds must contain less than 10% moisture. They normally contain 30-40% oil and 20-25% protein. A little cold-

pressed oil is produced and used for cooking. The seeds are normally heated before pressing and the resulting hot-pressed oil is a drying oil which will keep indefinitely in air-tight containers, but forms a hard film on exposure to the air. It is chiefly used in paints and varnishes.

Seed residues from hot pressing contain 33-43% protein and can be used for cattle feed. Those from cold pressing contain cyanogenic glucosides which make them poisonous. The whole seeds were used as food by the Greeks and Romans; in ancient Egypt linseed oil was only used for lighting (Darby et al. 1976, 783f.). Nowadays it is used for seasoning *Vicia faba* beans.

It is important to note that linseed contains cyanogenetic glucoside, and if seeds are allowed to soak in cold water enzymes will break down the glucoside, resulting in the production of poisonous hydrogen cyanide (prussic acid). For this reason it is important that linseed gruel should be prepared with boiling water (Gill & Vear 1958, 143).

There are very few palaeoethnobotanical finds of sesame seeds. Most relevant is the find reported by Piotrovsky of Urartian pots full of carbonized sesame seeds and cuneiform tablets at Karmir Blur, dating to between 1,000 and 600 B.C. (see Bedigian, this volume, pp. 168-70). Other early, finds of sesame, *Sesamum indicum*, come from further east. A lump of sesame seeds was found at Harappa (Vats 1940, 466-7), and sesame has also been reported from Ch'ien Shan Yang, a Late Neolithic Lung Shan culture site in Chekiang Province, China (Chekiang 1960). There are no detailed accounts of these finds. Recently G. Willcox has identified sesame in 2nd millennium levels at Shortugai, Northern Afghanistan (pers. comm.).

Wild sesame does not grow in the Middle East today. Nayar & Mehra 1970 consider that it must have originated as a crop plant either in India or in Ethiopia, or in both areas. The most likely wild ancestors of the cultivated form are either *Sesamum capense* or *Sesamum schenckii* both of which occur in Africa, India and the Far East, and both of which have produced viable F1 hybrids with *S. indicum*. On balance they consider *S. schenkii* to be the most likely ancestral species.

Sesame is important as an edible-oil crop of traditional agriculture in dry climates, and is grown widely in India, Pakistan, Iraq, Syria, Turkey, Sudan, Egypt and the more humid tropical regions of Africa. It has high heat and light requirements. Growth and fruiting are best at temperatures around 27° C. It is a drought-resistant crop in areas with a winter rainfall of 400 mm. The seeds mature 90-100 days after the first appearance of the seedlings. Seed maturity is uneven: the same plant may still be flowering at the top when the seeds at the base have ripened in their upright pods.

In the Near East sesame is sown in the late spring after the last rainfall. It may be grown as a single crop - planted through a funnel attached to a native "nail" plough in rows 50 cm apart, or it may be grown as a mixed crop, as in India with the seeds of both crops being sown broadcast and lightly covered with a harrow. Harvest starts when the lower pods

have ripened, and the plants are left to dry before threshing. The seeds contain 45-60% oil. The most useful property of the oil is its high stability, so that it does not turn rancid. The seeds are used in baking and confectionery. They may be pressed to extract the bland, edible oil. The oil cake remaining after pressing is a valuable concentrate for feeding to domestic animals, being rich in protein (20% or more) calcium, phosphorus and miacin (Arnon 1972, 381f.).

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PULSES RECORDED FROM ANCIENT IRAQ

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Lentils, Peas, Grass Pea/Blue Vetchling, Chick-pea, Horse-bean and Bitter Vetch all appear to have been cultivated in Iraq in antiquity, though none are found as frequently as cereals in the early deposits. In addition on the earliest sites in this area, as in Khuzistan in neighbouring Iran, seeds of a number of small wild legume species have also been found: in particular the seeds of small vetches, *Trigonella, Medicago, Astragalus* and *Coronilla* have been identified, but not in such quantities as to suggest that they were being grown or collected on a significantly large scale. The following finds have been recorded:

Site	Date	Lentil	Pea	Grass Pea	Chick-pea	Horse Bean	Bitter Vetch	Publication
Nahrwan Canal	Islamic	-	-	-	-	x	-	Helbaek 1965a
T. Bazmosian	Islamic	-	-	-	-	x	-	Helbaek 1965a
Nimrud	700-600 BC	x	-	x	x	-	x	Helbaek 1966
T. Bazmosian	ca.1500 BC	x	-	x	-	-	-	Helbaek 1965a
T. ed-Der	19-18th C BC	x	x	-	-	-	-	van Zeist 1985
Tell Taya	2300 BC	x	x	x	-	x	-	Waines 1973
Tell Yelkhi	2200-1800 BC	x	-	x?	-	-	x?	Costantini 1985
T.Bazmosian	2100-1800 BC	x	-	x	x	-	-	Helbaek 1965a
T. Qurtass	2100-1800 BC	x	-	-	-	-	x	Helbaek 1960c
Ur (Royal Gr.)	2500 BC	-	x	-	x	-	-	Ellison et al. 1978
T. Chragh	3500 BC	x	-	-	-	-	-	Helbaek 1960c
Choga Mami	Samarra	x	x	x	-	-	-	Helbaek 1973
Jarmo	6700 BC	x	x	x	-	-	-	Helbaek 1960a,1965a

1. Lentils - *Lens esculenta* Moench./*Lens culinaris* Medic.
Lentils appear to have been domesticated from the wild *Lens orientalis* which, at present, has a wide distribution from Turkey, Syria, Palestine, North Iraq, to West and North Iran. They belong to the spectrum of crops first domesticated together with cereals at the beginning of agriculture in the Near East (Hopf & Zohary, 1973). As a crop they are not very hardy, although they can withstand a certain amount of heat and drought, but they are very sensit-ive to excess soil-moisture. The pods split open on maturity (70-100 days after sowing) revealing one to three lens-shaped seeds. The seeds have a high protein content and are more easily digested than animal protein. They are often eaten in soups and stews. The following measurements are available for the early finds of lentil, and

show that most of them belong to ssp. *microsperma*, the small-seeded variety. Some, however, from Nimrud are larger and may be classed as ssp. *macrosperma*.

Lentil measurements

Site	Date	Measurement
Nimrud	Assyrian	diam. up to 5 mm
T. Bazmosian	Hurrian	diam. 1.83-4.94 mm
" "	Isin-Larsa	diam. 2.42-4.58 mm
T. Qurtass	Ur III	diam. 3.34 (2.38-3.84) mm
T. Chragh	3500 BC	diam. 2.93 mm
Choga Mami	Samarra	diam. 3.13-3.75 mm (+ some 2.0 mm)
Jarmo	6500 BC	diam. 2.5-3.0 mm

In some of the early finds they are associated with other crop plants. At Tell Taya they occurred in an Akkadian oven together with *Hordeum vulgare* (principal component), *Triticum dicoccum*, *T. aestivum*, *Lathyrus sativus*, and *Pisum sativum*). The find from Tell Qurtass (end of 3rd millennium B.C.) consisted chiefly of lentils found in a pot, and not much puffed by the carbonization process. A single lentil was found in a deposit of two-row barley at the 4th millennium site of Tell Chragh. The lentils at Tell ed-Der occurred with both cereals and other pulse crop seeds. At Nimrud lentils formed the chief pulse crop found with chick-peas in the citadel and with bitter vetch and grass peas in deposits from Fort Shalmaneser.

2. Peas - *Pisum* sp.
Field peas have been reported from Jarmo, Choga Mami, Queen Pu-abi's grave at Ur and in the Early Dynastic and Akkadian deposits at Tell Taya, and at Tell ed-Der. They are usually found with wheat and barley, and occasionally with other pulses. Those found at Ur were very small, measuring 2.4-3.5 mm in diameter, average 2.9 mm. Those from the Early Dynastic levels at Tell Taya measured 3.0 x 3.0 mm and 3.5 x 2.7 mm respectively. The cultivated pea, *Pisum sativum* appears to have been domesticated from its closely related wild forms *Pisum elatius* and/or *Pisum humile*. The clearest indicator of domestication is the replacement of the rough seed-coat with a smooth one (Hopf & Zohary 1973). In regions of mild winters and low rainfall peas are grown as a winter crop. A minimum precipitation of 300 mm is needed, and they are best suited by light to medium soils with a high calcium content. Irrigation at the beginning of flowering is highly beneficial, in dry regions, and may increase the yield by 30%; if it is continued whilst the pods are swelling it may again increase the yield (Arnon 1972).

3. Grass pea/Blue vetchling - *Lathryus sativus*
This is another pulse crop of great antiquity in this area, having been found at Jarmo and Choga Mami. At Tell Bazmosian it formed the chief component of one deposit with a small admixture of lentils. At Tell Taya it

occurred in an early 2nd millennium oven and in an Akkadian oven, in both cases associated with naked and hulled wheats and barley, and in the Akkadian examples also with peas and lentils. They were found with Bitter Vetch in the deposit from Fort Shalmaneser, Nimrud.

This is one of the hardiest of the legumes, being drought-resistant and also withstanding waterlogging better than the other pulses. Because of its drought-resistance, it is a famine crop and will survive in seasons when the cereals fail. In Iraq it occurs as a weed in cereal crops especially in irrigated fields. It is used in much the same way as the other pulses, but it will cause the disease lathyrism if eaten in large quantities, and this results in partial paralysis of the lower limbs.

4. Chick-pea - *Cicer arietinum*
Three finds of chick-peas are reported from Iraq: some were found in a silver water-pot with an attached gold drinking tube in Queen Pu-abi's grave at Ur. Here they were preserved as mud impressions (Ellison et al. 1978). Carbonized chick-peas were found in the Isin-Larsa levels at Tell Bazmosian, with a diameter of 4.56 mm, and in the later Hurrian levels at the same site they measured 4.03-4.60 mm (Helbaek 1965). At Nimrud there was a greater range in size from 3.67 to 5.44 mm in diameter (Helbaek 1966). Chick-peas are widely cultivated in the warm, semi-arid areas around the Mediterranean and Near East. They prefer medium to heavy soils. The plant is susceptible to excess humidity and will not thrive on poorly drained soils. They are the most tolerant of pulse crops to soil salinity, and are extremely sensitive to frost. They form an important human food eaten raw, boiled, salted or sugared, roasted, or in soups or as a purée. They can also be used as a pot herb. The green parts of the plant and the haulms are toxic and so are unsuitable for use as fodder.

5. Broad bean - *Vicia faba* L.
So far this species has not been found in the earliest contexts in Iraq, but it is known that the beginnings of its cultivation go back to about 6000 B.C. at Jericho. Helbaek reported the earliest finds known to him in Iraq as from the excavations of 1957-1958 of the large weir on the Nahrwan Canal east of Khafajah (Safar 1960), where the seeds had a maximum length of 18 mm (Helbaek 1965). The Islamic broad beans from Tell Bazmosian measured:

Length	8.0-14.0 mm	av. 10.5 mm
Breadth	6.0-10.0 mm	av. 7.3 mm
Thickness	3.8-7.0 mm	av. 5.0 mm

All these finds are of the large-seeded broad bean.

One seed is reported by Giles Waines from inside an Akkadian oven at Tell Taya (Waines 1973). It measured 13.0 x 8.0 mm. It was found together with *Lathyrus sativus*, *Vitis vinifera*, *Triticum dicoccum*, *Hordeum vulgare*, *Olea europaea* and *Quercus* sp.

They are probably the least drought-resistant of all the pulses and are best suited to medium and heavy soils, and respond well to a high calcium content. Irrigation is of great benefit during flowering, pod-set and seed formation in dry areas (Arnon 1972).

6. Bitter or Camel Vetch - *Vicia ervilia*

In the Ur III period at Tell Qurtass 40 Bitter Vetch seeds were found in a pot which was chiefly filled with lentils. Helbaek described the seeds as being angular-roundish and often having small depressions about the hilum, while the radicle is situated in a triangular, almost flat surface (Helbaek 1960). They measured 2.93-4.03 mm in diameter with an average of 3.48 mm. The only other find of this species from Iraq comes from a deposit in Fort Shalmaneser, Nimrud, where they occurred with Grass Peas and lentils (Helbaek 1966).

This species was probably first domesticated in Anatolia where it is commonly found on early farming sites, and became very popular in late Neolithic times in the southern Balkans. Very few palaeoethnobotanical finds occur to the east of Anatolia. It is used as a fodder plant especially for sheep, and may be used as an excellent green manure. Because of its bitter taste it is used as human food only by the very poor or in times of famine.

7. Small legumes

Seeds of wild leguminous plants have been found at Choga Mami in the Samarran levels (Helbaek 1973). They belong to the Ray-podded Medick *Medicago hispida*, clover *Trifolium*, Milk Vetch *Astragalus*, and a number of vetch and vetchling species. Seven seeds of unidentified vetches were found at Tell Bazmosian, together with a single seed of *Coronilla scorpiurus*, crown vetch. These small legumes do not appear to have played a significant role in the economy of the settlements in which they were found.

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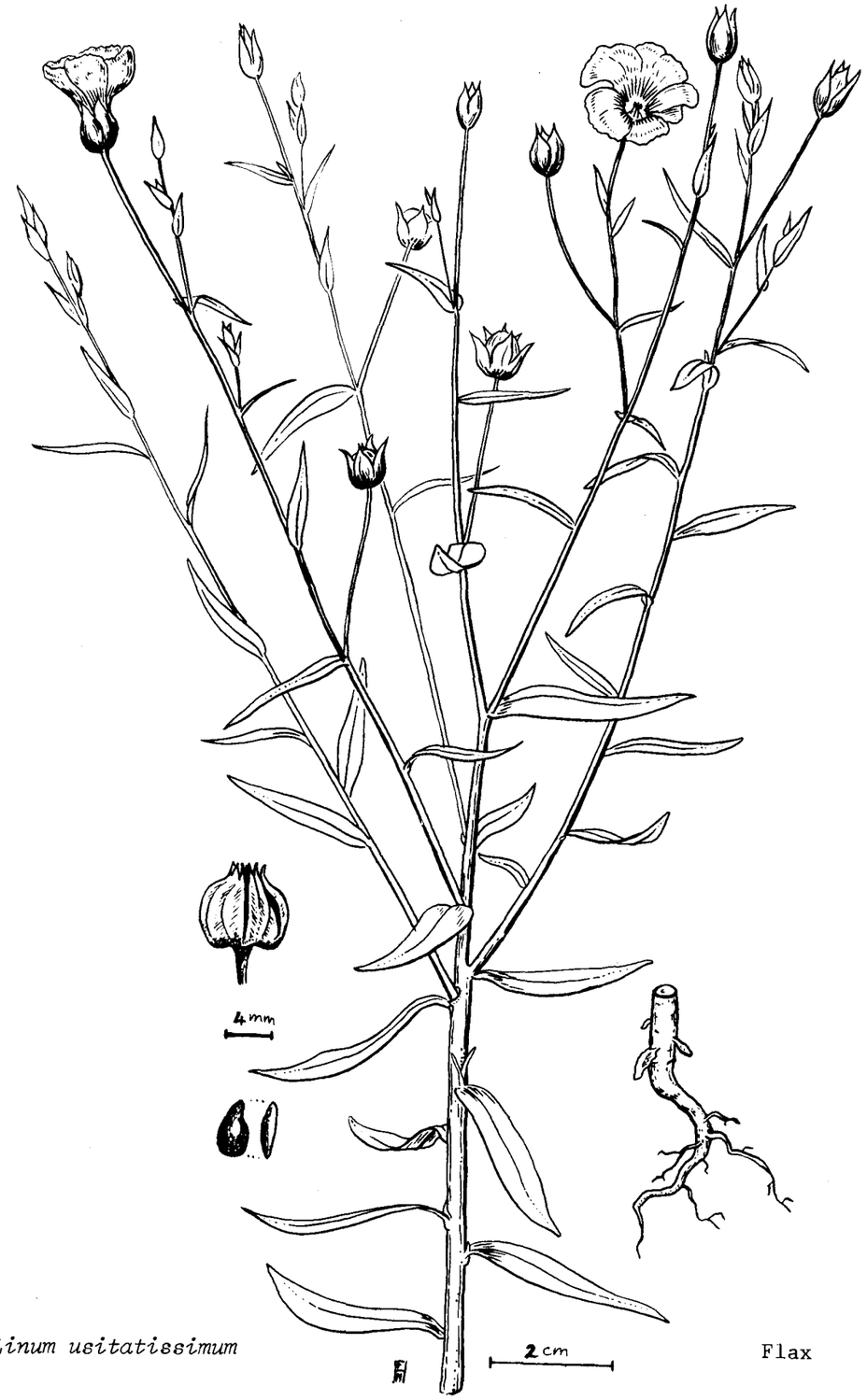

Linum usitatissimum Flax

A NOTE ON THE VEGETATION ON THE URUK VASE

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The cover of this bulletin is decorated at the top with the frieze of animals shown on the Uruk vase; at the bottom is the frieze of plants which forms the lowest register of decoration on the vase. The vase is usually dated to the end of the Uruk period and was found in Level III of the great Inanna precinct at Warka. It is made of alabaster and stands about 1m high. It is undoubtedly one of the outstanding examples of early art anywhere in the world, and the ancient repairs indicate how highly it was prized at the time. The theme of the decoration is clear, even if some of the details are obscure. It shows the presentation of harvest offerings to Inanna, or the priestess who represented her. The figure of the main human participant is unfortunately missing, only an attendant, a "page-boy", survives, holding what seems to be a great tassel, apparently part of the regalia.

The figures are arranged in horizontal bands running round the vase; below each of the bands with figures is a blank register; below these is a file of animals, sheep or goats, the males with great horns and beards. The lowest band depicts two types of plant apparently growing on the edge of a watercourse. Although this part of the vase was extensively damaged when it was found, enough remains to substantiate the reconstruction shown on the cover where what are plainly ears of corn, either wheat or barley, alternate with another plant. The ears of corn are very stiff and stylised as are the representations of grain on other artefacts, such as the macehead from the Iraq Museum. This macehead may also depict the second of our pair of plants, but the photograph is inadequate for definite identification.[1] On seals too, where corn is shown as an offering, as an appurtenance of grain gods/goddesses and in at least one case over the backs of a file of handsome cattle, there is little attempt at realism. An exception to this can be seen on the fine steatite vase from Ur which also shows a file of cattle with ears of what is apparently six-row barley.[2]

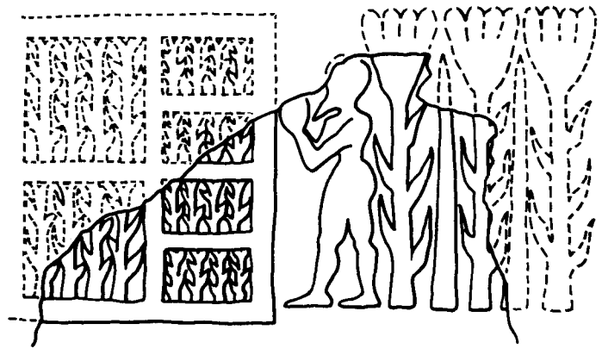

Fig. 1

The second plant on the vase has a tall, thick stem with pairs of leaves growing from it; near the top it divides into three smaller stems

each topped with a flower or seedcase. Frankfort interpreted this second plant as a date palm, but it lacks the great sagging bunches of fruit on either side of the trunk which usually characterise the palm in Sumerian art, as shown for example on a stone plaque from Tello.[3] As with the ears of corn, this plant is clearly stylized, and allowing for this, it seems reasonable to compare it with a drawing in Gill and Vear's *Agricultural Botany, I,* of *Linum usitatissimum* L.,[4] flax or linseed which has the same tall stem, short leaves and smaller branches at the top (see also p. 72). E. Strommenger in an article on a stele fragment from Uruk has already tentatively suggested that this second plant on the Uruk vase should be identified as hemp or flax (Fig. 1).[5] She also illustrates a cylinder seal from Jemdat Nasr, which although badly damaged shows three different plants of which two appear to be our pair and the third resembles *Prosopis*, or some other fodder plant, thus if the identifications are correct, representing the three main types of plant on which the Sumerian farmer depended (Fig. 2).[6] Another representation of this same pair of plants occurs on a seal impression from the Stampflehmgebäude in the Eanna precinct (Fig. 3); stylistically this impression appears to be of the same date as the vase.[7] The impression also shows two men, apparently in a watch-tower or similar building, perhaps watching over the crops.

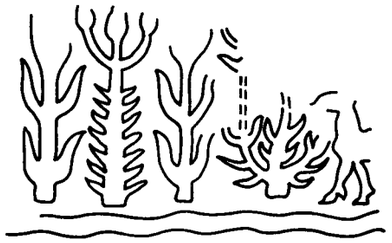

Fig. 2

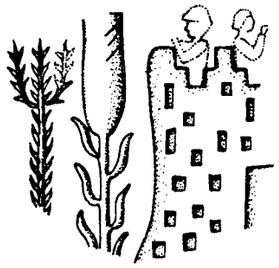

Fig. 3

If this second plant is indeed *Linum*, we have another shred of evidence for its cultivation in the Uruk period, in spite of its absence from the archaeological record at this period. It is interesting to note that in all the examples quoted the emphasis is on the tall, thick stem, suggesting perhaps that the plant was being grown for flax fibre rather than for oil. Today denser sowing, when growing for flax fibre rather than linseed oil, produces a taller plant with a thicker stem. There is no mention of oil extraction as early as this in the textual material, but from Uruk III there are references to **gada** or linen fabric (see Hartmut Waetzoldt, this volume, p. 77).

The tendency towards a stylized representation of plants rather than a naturalistic one, can also be seen on a number of cylinder seals from the Protoliterate period which show different sorts of animals being hand fed. One seal from Khafaje shows two cervids being offered a spiky branching plant by a mythical creature standing on its hind legs. The charming seal, also from Khafaje, with two goats or deer grazing, shows them eating

a different plant with pods or buds growing from a stylized mountain.[8] In both cases the artist seems to be trying to convey the generalised idea of "fodder" rather than any specific plant. The same may be true of another group of seals showing animals eating eight-petalled flowers, a form which is virtually unknown in nature. The eight-petalled flower is closely similar to the stone and clay flowers which are typical architectural decoration around 3,000 B.C. It is perhaps significant that at Al Ubaid, slightly later, they are found associated with the great frieze depicting the temple herds.[9] It seems possible that the artist may even be conveying the idea of the feeding of the temple herds on some kind of celestial food. Certainly it is no ordinary feeding: on two of the seals in question the symbol of Inanna is prominent in the design and in another we see the façade of two temples.[10] The herdsmen in the first two seals under discussion are wearing the curious net skirt which seems to have some ritual significance, but which was certainly not the everyday wear of farmers.

Even a superficial review of the decorative art of the late 4th/early 3rd millennia seems to show that in general stylization rather than naturalism was the fashion in depicting plants. The artists seem to have wished to portray classes of plants - grain, fodder or reeds - rather than a particular variety; the same convention can be seen on the Jemdat Nasr painted pottery and on the slightly later Scarlet wares. This tendency towards stylization strengthens the case for identifying the second plant on the lowest register of the Uruk vase as *Linum*, probably grown for its fibre rather than oil, and explains any botanical inadequacy in its portrayal. It was not necessary according to the prevailing artistic canons to attempt a naturalistic rendering. It seems entirely logical that two such economically important plants as corn and flax should complete the decoration on this great vase with its theme of the offering of the fruits of the earth to the great goddess.

NOTES

1 Macehead is illustrated in Faraj Basmachi, *Treasures of the Iraq Museu* (Baghdad 1972), fig. 28.

2 This vase is illustrated in Basmachi, op. cit., fig. 27.

3 H. Frankfort, *Art and Architecture of the Ancient Orient* (Pelican), p. 25.

4 N.T. Gill & K.C. Vear, *Agricultural Botany I* (Duckworth 1969), fig. 38, p. 145.

5 After E. Strommenger, "Zu ein Frühsumerischen Stelenfragment aus Uruk", in *Archäologischer Anzeiger*, 1967, Heft I, Abb. 1 on p. 2.

6 After E. Strommenger, ibid., Abb. 4 on p. 5.

7 I am greatly indebted to Dr. Uwe Finkbeiner for a drawing of this impression (W 24012, 15), which is to be published in UVB 33/34, and to Prof. J. Schmidt for permission to make use of it. Scale 1:1.

8 H. Frankfort, *Stratified Cylinder Seals from the Diyala Region* (Chicago 1955), Pl. 6, no. 34 and Pl. 10, no. 71.

9 H. Hall, *A Sseason's Work at Ur* (London 1930), p. 249 and fig. 231, and H. Hall & C.L. Woolley, *Ur Excavations I: Al 'Ubaid* (Oxford 1927), pp. 118-9.

10 E. Strommenger, *Art of Mesopotamia* (London 1964), Pl. 17, and H. Frankfort, *Stratified Cylinder Seals from the Diyala Region*, Pl. 6, no. 31.

ÖLPFLANZEN UND PFLANZENÖLE IM 3. JAHRTAUSEND

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Die älteste in den Texten bezeugte Ölpflanze ist nicht etwa Lein oder Sesam, sondern der Ölbaum. Texte aus Ebla, die aus der Zeit kurz nach 2500 v. Chr. stammen, zählen tausende dieser Bäume auf.

So wachsen auf 2260 **gána-kešda.**KI 1000 Bäume, auf 1100 **gána-kešda.**KI 500 oder auf 600 **gána-kešda.**KI 500 Bäume[1]. Demnach stehen durchschnittlich 2,2 oder nur 1,2 Ölbäume auf 1 **gána-kešda.KI.** Leider wissen wir nicht, wie gross dieses Flächenmass ist, um feststellen zu können, wie dicht die Bäume wuchsen. Die Bezeichnung für diesen Baum ist **giš-ì-giš**, seltener auch abgekürzt **giš-ì**[2]. Wörtlich kann man das übersetzen mit "Baum des Baumöls", bzw. "Ölbaum". Das Olivenöl wird **ì-giš**[3], also wörtlich wohl "Baumöl" genannt. Eine andere Ölsorte ist m.W. in den Ebla-Texten nicht bezeugt.

In Mesopotamien begegnet Olivenöl erst rund 400 Jahre später in Texten aus Girsu[4]. Interessanterweise gibt es dafür kein sumerisches Wort, sondern es wird das akkadische, nämlich *serdu* (AHw 1037) verwendet. In den zehntausenden von Ur-III-Texten ist Olivenöl m.W. nicht bezeugt. Erst in den rund 250 Jahre jüngeren Mari-Texten finden wir es häufiger[5]. Das Holz des Olivenbaumes lässt sich allerdings früher in Mesopotamien nachweisen als das Öl. Daraus wurden nach einem altakkadischen Text (BIN 8, 260:4) die Füsse eines Bettes angefertigt. Die Seltenheit der Belege spricht eindeutig für Import sowohl des Ölbaumholzes als auch des Olivenöls.

Ein anderer Baum, dessen Früchte ab der altakkadischen Zeit zur Ölgewinnung benutzt werden konnten, scheint aber im babylonisch-assyrischen Raum gewachsen zu sein. Dafür könnte die relative grosse Zahl der Belege sprechen. Es handelt sich um den Mandel-Baum, dessen Holz zu verschiedenen Gegenständen[6] und aus dessen ölhaltigen Früchten[7] Öl gewonnen wurde[8]. Die genannten Mengen sind aber stets gering.

Der Vollständigkeit halber sei auch noch das Vorkommen von Zedernöl erwähnt. Hierbei ist allerdings unklar, ob es sich um Öl handelt, das aus den Samen gewonnen wurde oder um irgendein Öl, das z.B. mit Zedernharz 'parfümiert' wurde[9].

Nach dieser kurzen Einleitung nun aber zum Hauptteil, zu Lein und Sesam: Flachs lässt sich archäologisch m.W. etwa seit dem Ende des 6. Jahrtausends nachweisen[10], in den Keilschrifttexten ab der Schicht Uruk III, also etwa der Jemdet Nasr-Zeit[11]. Die Pflanze und die Fasern, bzw. die daraus gefertigten Fäden heissen sumerisch **gu**, Leinengewebe **gada.** Das Akkadische unterscheidet dagegen nicht zwischen der Pflanze, den Fasern und dem Leinenstoff, alles wird mit *kitû* bezeichnet[12]. Leinsamen findet nur sehr selten Erwähnung, Leinöl fehlt m.W. sowohl in den sumerischen als auch in den akkadischen Texten[13] völlig.

In altakkadischen Texten[14] begegnet eine Brotsorte **ninda-gu**, doch muss offen bleiben, ob es sich um Leinsamenbrot oder um ein Brot aus einer später **zì-gu**[15] genannte Mehlsorte handelt.

Die Ernte des Flachses erfolgte in Lagaš im XII.[16], in Umma im I. Monat[17], das entspricht etwa April/Mai. In dieser Zeit wird auch die Gerste geerntet. Da Flachs eine Wachstumszeit von 3-4 Monaten hat, muss er etwa Dezember/Januar gesät worden sein. Flachs war also in Mesopotamien eine Wintersaat[17a].

Die Bauern, welche Flachs anbauen, werden **engar-gu** (oder **lú-gu**) genannt. Manchmal bezeichnete man sie auch als Gärtner[18], was sicher als Hinweis gewertet werden kann, dass Flachs relativ kleinflächig angebaut wurde. Dafür spricht auch die verhältnismässig geringe Menge des geernteten Flachses. Die Anbau-fläche machte nur einen Bruchteil der Getreideanbaufläche aus. So werden nach einem Text (CT 9, 47, 20015:1-13) von insgesamt ca. 579 Hektar Fläche nur 4,2 Hektar oder 0,7% als **ki-gu**[19], also als Flachsland, ausgewiesen.

Die Deutung von **gu** als Flachs/Lein ist m.W. in den letzten Jahrzehnten nicht mehr in Zweifel gezogen worden. Dazu bestand auch keinerlei Anlass. Auf einige Punkte des gerade Gesagten werde ich später aber noch zurückkommen müssen. Soviel sei aber jetzt schon zu Leinöl gesagt: In vielen Kulturen wurde Flachs nur als Faserpflanze angebaut, ohne dass man Öl aus den Samen gewonnen hätte[20]. Es spricht alles dafür, dass dies in Mesopotamien auch der Fall war. Aus dem Samen, der je nach Sorte und Standort zwischen 30 und 44% Öl enthält[21], kann man ein Öl gewinnen, das rasch ranzig wird und an der Luft relativ schnell trocknet. Die heutigen Verfahren zur Herstellung eines stabiles Leinöls für Speisezwecke, waren in so früher Zeit wohl noch nicht bekannt. Technisch ist Leinöl als Grundmaterial für Lacke und Firnisse bestens geeignet[22].

Über Sesam und ob es sich bei **še-giš-ì** wirklich darum handelt, wurde schon viel diskutiert. Zitieren möchte ich nur die grundlegende Arbeit von F.R. Kraus in *Journal of the American Oriental Society* 88, 112-119. Dort sind sehr viele Argumente zusammengetragen, die für eine Interpretation als Sesam sprechen. In diesem Artikel wurden allerdings die Quellen aus dem 3. Jahrtausend nur in geringem Masse berücksichtigt. Hier soll versucht werden, diese Lücke zu schliessen.

Die Körner, bzw. Samen der hier zu diskutierenden Pflanze werden in den Texten mit sumerisch **še-giš-ì** und das daraus gewonnene Öl mit **ì-giš** bezeichnet. Nur in Texten aus der Akkad-Zeit findet man dafür auch **ì-giš-ì**[23]. F. R. Kraus vertritt in seinem gerade zitierten Artikel (S. 115a) die Meinung, es gäbe keine Pflanze mit dem zu rekonstruierenden Namen **giš-ì**. Dies trifft jedoch nicht zu:

1. werden mit dieser Pflanze bestellte Felder als **ki-giš-ì**[24] bezeichnet, ähnlich wie Flachs- oder Zwiebelfelder als **ki-gu** oder **ki-sum**[25]. Auf diesen Feldern sind Leute bei Arbeiten an den Bewässerungseinrichtungen eingesetzt (BIN 5, 272:194) oder beseitigen Unkraut (?) (**giš gi ú zé**, MVN 12, 15:3). Die Anbaufläche scheint nach

der Zahl der Belege für die Felder und besonders nach den verbuchten Ölmengen grösser gewesen zu sein als bei Flachs. In einem Text werden über 5% der gesamten Feldfläche als **ki-giš-ì** bezeichnet (HLC III 141, 373.III.7).

2. gab es Spezialschiffe für den Transport dieser Pflanze: **má-giš-ì**[26].

3. werden die Pflanze, bzw. deren Samen beim Verkauf häufiger **giš-ì** genannt[27]. Dies verdeutlicht besonders ein Brief[28]. Darin werden erst 135 Kor **še-giš-ì** erwähnt und dann, als es um den Verkauf geht, steht nur **giš-ì**. Ähnlich auch in Amherst 117:1ff.: Bei der Einlieferung tragen die Körner die Bezeichnung **še-giš-ì**, danach nur noch einfach **giš-ì**[29].

4. wird in TU 114 II 11f. und V 25f. die Wertrelation zwischen Datteln und **giš-ì** angegeben.

5. nannte man die Frauen, die das Öl aus den Samen pressten, **géme-giš-ì-sur-sur** (CT 3, 20.VII.28-VIII.3, STA 2.IV.4, TU 101.IV.15) oder abgekürzt **géme-giš-ì** (MVN 6, 492 Rs. 2,5).

6. hiessen die Bauern, die diese Pflanze anbauten **engar-giš-ì**[30] oder **engar-še-giš-ì** (MVN 1, 208:2, UET 3, 1129 Rs. 11ff., 1443:17).

7. in einer Abrechnung über Sesam (TLB 3, 152) heisst es als Schlussvermerk "Abrechnung über **giš-ì**" (**nì-kas$_x$-aka giš-ì**), nicht **še-giš-ì**.

Zusammenfassend lässt sich feststellen, dass mit **giš-ì** hauptsächlich die Pflanze, aber auch als Abkürzung für **še-giš-ì** der Samen bezeichnet werden konnte.

Schwierigkeiten für eine Interpretation als Sesam werden auch in den Wörtern **giš-ì** und **ì-giš** selbst gesehen. Dies liegt an dem Element **giš**, das meist mit "Holz" oder "Baum" zu übersetzen ist[31]. Est trifft selbstverständlich zu, dass **giš** in der Regel Hölzer und Bäume bezeichnet, doch dient es im Sumerischen ebenso zur Benennung von kleinen verholzten Gewächsen.

Die Ebla-Texte könnten aber ein völlig neues Licht auf die Herkunft des Wortes **giš-ì**, bzw. **ì-giš** werfen. Dort verwendete man - wie wir gesehen haben - die Sumerogramme **giš-ì-giš**, bzw. abgekürzt **giš-ì** für den Olivenbaum und **ì-giš** für Olivenöl. Nun die provokative Frage: Sollte man in Mesopotamien diese Bezeichnung eines Pflanzenöls von der Olive einfach auf den Sesam übertragen haben? Dann würde sich das Wort von selbst erklären und es wäre auch verständlich, warum in Mesopotamien das Olivenöl mit dem semitischen Namen bezeichnet wurde und nicht etwa mit einem sumerischen, denn das beste dafür mögliche sumerische Wort war schon für eine andere Ölpflanze verbraucht. Eine gewisse Parallele liegt möglicherweise bei der Bezeichnung für Silber **kù:babbar** vor. In Mesopotamien wurde Silber in der präsargonischen Zeit **kù-luh-ha** genannt, das in Ebla übliche **kù-babbar** taucht nur selten und dann vorwiegend in literarischen Texten auf[32]. In der Akkad-Zeit hat dann die aus Ebla schon lange bekannte Bezeichnung **kù:babbar** das mesopotamische **kù-luh-ha** völlig verdrängt[33]. Wie ich erst

nachträglich bemerkte, nachdem ich diese Zeilen bereits geschrieben hatte, vermutet auch Kraus (JAOS 88, 115) in seinem Artikel über Sesam, dass **i-giš** bzw. **še-giš-i** Entlehnungen aus einer dritten, nicht-mesopotamischen Sprache sein könnten.

Eine gewisse Bestätigung für die oben aufgestellte These könnte man auch in der zeitlichen Stellung der Texte sehen. Die Ebla-Texte lassen sich in die Zeit um 2500 v. Chr. datieren. Die frühesten Belege für die Bezeichnungen **giš-i**, **še-giš-i** und **i-giš** in Mesopotamien stammen aber erst aus der Akkad-Zeit. Besonders etwa seit der Zeit Naramsîns gibt es relativ viele Erwähnungen[34]. Es liegen also rund 250 Jahre zwischen den Ebla-Texten und dem häufigeren Vorkommen dieser Bezeichnungen in Mesopotamien.

Die Pflanze **giš-i** und ihr Öl sind also in mesopotamischen Texten nicht vor etwa 2250 v. Chr. nachweisbar[35]. Bei Ausgrabungen kann man folglich erst in Schichten aus dieser Zeit Samen dieser Pflanze in nennenswerteren Mengen finden.

Wo und auf welche Weise die Mesopotamier diese neue Pflanze kennenlernten, muss derzeit offen bleiben. Möglich wäre, dass man sie während der Kriegs- und Beutezüge Sargons und seiner Nachfolger irgendwo im syrisch-assyrischen Raum[36] oder in Elam vorfand. Doch könnte sie, bzw. ihre Samen auch aus einem anderen Gebiet zusammen mit anderen Dingen importiert worden sein. Auffällig bleibt aber, dass, wenn in der Zeit kurz vor 2000 v.Chr. **še-giš-i** importiert wurde, dieses in der Regel aus dem Gebiet von Karhar stammt[37]. Diese Stadt Karhar wird in das Ost-Tigris-Land zwischen Arrapha und dem Dijala-Fluss lokalisiert[38]. Interessanterweise war dieses Gebiet - nach freundlicher Auskunft von K. Deller - auch noch in der Zeit der Nuzi-Texte, also rund 600 Jahre später, eines der bedeutendsten Anbaugebiete für **še-giš-i**. Auf Importe aus Susa, bzw. dem elamischen Gebiet dürfte RT 22, 1900, 153, 2 hinweisen. Der Transport erfolgte auf 6 Schiffen mit je 60 Kor Tragfähigkeit[39].

Die aus Karhar angelieferten Mengen sind mit 135 Kor oder rund 34.100 Litern[40] recht beträchtlich. Die sonst in den Texten genannten Mengen liegen mehrfach in diesem Bereich, nur selten höher[41]. Die grösste Quantität erwähnt ein Text aus Ur mit insgesamt 470 Kor oder ca. 118.720 Litern[42].

Die Einsaat ist nicht direkt bezeugt, dafür aber die Ausgabe von Saatgut. Diese erfolgte in der Provinz Lagaš in der Regel im 2. Monat[43], nur einmal ist der 3. Monat bezeugt[44]. Die erwähnten Mengen an Saatgut sind mit ca. 126 bis 505 Litern relativ gering. Ein einziger Text nennt 10 Kor oder ca. 2526 Liter[45]. Wieviel Feld man damit einsäen konnte, muss wegen fehlender Textangaben aus dieser Zeit offen bleiben. Legt man den Wert aus einem altbabylonischen Brief[46] mit einer Saatmenge von 7 **sìla** je **iku** (ca. 5,894 Liter je 3528 m^2 oder ca. 16,704 Liter je Hektar) zugrunde, so hätte man mit diesen ca. 2526 Litern rund 151,2 Hektar oder ca. 1,5 km^2 bestellen können.

Ebenfalls aus dem 2. Monat stammt ein Text[47] über Arbeiter, die auf einem 'Sesam'feld Sträucher, Rohr und (Un)kraut ausschnitten. Vielleicht

ist damit gemeint, dass Unkraut auf diesem Feld beseitigt wurde, um den Boden für die kommende Saat vorbereiten zu können.

Die Saat erfolgte in der Provinz Lagaš nach den Texten aus der Zeit kurz vor 2000 v.Chr. also in den Monaten Mai/Juni, selten erst Anfang Juli.

Die Erntezeit lässt sich anhand der Texte weniger genau festlegen, da m.W. kein datierbarer Text direkt von der Ernte berichtet. Überblickt man jedoch die einschlägigen Texte aus der Provinz Lagaš, so fällt auf, dass auffällig viele in den 5. Monat[48], etwa August/September datiert sind. Dies legt die Vermutung nahe, dass in diesem Monat die Ernte stattfand, wir folglich mit einer Wachstumszeit von gut 3 Monaten zu rechnen haben. In der Nachbarprovinz Umma war **še-giš-i** im 11. Monat versandfertig[49], müsste also vorher geerntet, getrocknet, gedroschen und gereinigt worden sein. Wenn man für all diese Arbeiten 2 Monate ansetzt, käme man für die Ernte etwa in den Monate November/Dezember. Dies scheint etwas spät, da Sesam meist nach gut 3 Monaten, höchstens nach 6 Monaten reif ist[50]. Der einzige Text (TU 164^{10}:2f.), der von gesiebtem? **še-giš-i**[51] spricht, ist leider undatiert. Spezielle Siebe sind einige Male bezeugt (Salonen 1965,72e).

Zusammenfassend lässt sich zu Saat und Ernte sagen, dass im Mai/Juni, selten später gesät wurde. Wir haben es also - im Gegensatz zu Flachs - eindeutig mit einer Sommerfrucht zu tun. Auch im heutigen Iraq ist Sesam eine Sommerfrucht[50]. Das Datum der Ernte nennt m. W. bisher kein Text ausdrücklich, doch konnte der 5. Monat (August/September) für die Provinz Lagaš wahrscheinlich gemacht werden.

Über die einzelnen Arbeitsgänge, die nach der Ernte notwendig sind, also über die Nachreife, Ausklopfen und schliesslich das Reinigen durch Sieben und vielleicht auch Worfeln[52], berichten die Texte leider nichts. Nur die letzte Arbeit, das Sieben? (und Worfeln?) ist einmal belegt (s. oben). Ob die mit BÚR bezeichnete Arbeit an **še-giš-i** hierher gehört (MVN 1, 208:5), lässt sich derzeit nicht entscheiden.

Leider ebensowenig sind wir über die Einzelheiten der Ölgewinnung informiert. Wir erfahren nur aus mehreren Texten, dass man in Lagaš aus 300 **sìla še-giš-i** 60 **sìla i-giš**-Öl presste[53]. In Umma erreichte man nach einem unveröffentlichten Text ca. 66 **sìla**. In Liter umgerechnet heisst das, aus 252 Litern Samen gewann man in Lagaš 50,5 Liter Öl, in Umma einmal 56 Liter. Die Ölausbeute betrug folglich nur 20 bis 22%. Interessanterweise wird auch in einem Buch aus dem Jahre 1806[54] berichtet, dass man aus Sesamsamen zwischen 22,2 und 25% Öl gewinnen könne. Die Ölgewinnungsmethode scheint sich demnach in der langen Zwischenzeit nicht verbessert zu haben, denn Sesam enthält nach W. Fischer[55] zwischen 47-57% Fett. Die Ölausbeute wäre damals also nicht sehr hoch gewesen.

Der Terminus für die Ölgewinnung ist sumerisch **sur**. Er kommt besonders in der Berufsbezeichnung der Ölpresserinnen (**géme-(giš-)i-sur-(sur)**)[56] und in der Gebäudebezeichnung **é-i-sur-ra**[57], sonst aber selten vor[58].

Einige Aufschlüsse geben auch die Preise für **še-giš-i**. Für 1 Sekel Silber konnte man zwischen 60 und 100 **sìla** Körner[59] kaufen. Die Texte sind leider nicht nach Monaten datiert, so dass man nicht feststellen kann, ob es saisonale Schwankungen gab ob Qualitätsunterschiede den Preis bestimmen.

Der Preis des **ì-giš**-Öls betrug in Lagaš und Nippur 1 Sekel Silber für 9 bis 12 **sìla** Öl[60]. In Umma erhielt man für 1 Sekel Silber nach einem Text[61] rund 10 **sìla** Öl. Ein Dokument unbekannter Herkunft weist auf eine Wertrelation von einem Sekel Silber zu 12,8 **sìla** Öl[62]. In Notzeiten, als die Hauptstadt Ur von der Versorgung durch die anderen Provinzen abgeschnitten war, erhielt man für 1 Sekel Silber nur 2,5 **sìla** Öl[63], d.h. das Öl war 4,8 mal so teuer wie sonst.

Vergleicht man nun den Preis der Körner mit dem des Öls, so ergibt sich meist eine Relation von 1:5 oder 20%. Das bedeutet, dass die Körner nur 1/5 des Öls kosten oder anders ausgedrückt, der Wert der Körner bestimmte sich durch den Ölgehalt, denn wir haben ja gerade festgestellt, dass man aus den Körnern ca. 20% Öl gewinnen konnte.

Die Preisunterschiede des Öls dürften zum Teil durch Qualitätsunterschiede, zum Teil auch durch jahreszeitliche Preisschwankungen bedingt sein. Um den Preis des **ì-giš** richtig bewerten zu können, hier noch einige Preise für andere Öle und Fette. Für 1 Sekel Silber konnte man in der Regel folgende Quantitäten kaufen: 15 **sìla** Schweineschmalz, 20 **sìla** Schaffett, 30 **sìla** Fischöl, aber nur 10 **sìla** 'Butterschmalz' (**ì-nun**) oder 5 **sìla** "gutes Öl/Fett" (**ì-du$_{10}$-ga**)[64]. Der Preis des **ì-giš**-Öls liegt folglich zwischen dem des 'Butter'- und des Schweineschmalzes.

Wichtig für die Bedeutungsbestimmung von **še-giš-ì** und **ì-giš** ist aber weniger der Preis als die Verwendung des Öls. Grosse Mengen dieses Öls werden zu Nahrungszwecken und Opfer verbraucht[65], man muss also annehmen, dass es ein gutes Speiseöl war. Gegessen wurden übrigens auch die Pressrückstände[66] und die Körner[67]. Die Körner konnten auch in Brot verbacken[68] und das Öl bei der Herstellung von Früchtekuchen verwendet werden[69].

Das **še-giš-ì** besass eine gute Lagerfähigkeit, denn es wurde ganzjährig für die Weiterverarbeitung ausgegeben und daraus Öl gepresst. Auch konnte es offenbar ohne Qualitätsverlust über grössere Strecken (z.B. von Susa in die Provinz Lagaš (Transportzeit wahrscheinlich etwa einen Monat) transportiert werden (RT 22, 153:2). Die Lagerfähigkeit des **ì-giš**-Öls scheint ebenfalls recht gut gewesen zu sein, denn die Vorratshaltung erfolgte in grossen Tongefässen mit ca. 84 bis 174 Litern Fassungsvermögen[70]. Auch gab es keinerlei Schwierigkeiten, das Öl über grössere Strecken mit dem Schiff zu transportieren so z.B. von Ur nach Nippur[71]. Diese Strecke beträgt rund 150 km und zu Schiff konnte man sie damals in 10 bis 11 Tagen bewältigen[72]. Schätzt man die Zeit von der Herstellung des Öls bis zum Verbrauch in diesem Fall auf 15 Tage, so wäre Leinöl kaum noch zum menschlichen Verzehr geeignet gewesen.

Von besondere Wichtigkeit scheint mir auch der technische Gebrauch des **ì-giš**-Öls. Und zwar sind 4 Bereiche zu unterscheiden:

1. Textilindustrie und 'Seifen'
2. Lederindustrie
3. Holzindustrie
4. Sonstige Verwendungen

1. In der Textilindustrie benutzte man das **ì-giš**-Öl, selten auch das "gute **ì-giš**-Öl"[73] neben Alkali-haltiger Asche zum Walken und Waschen der fertig gewebten Wollstoffe. Das **ì-giš**-Öl muss sich also zur Herstellung von Seifen bestens eignen, denn es wird besonders für Stoffe bester Qualität verwendet. Billigere Stoffe behandelte man dagegen mit Schweineschmalz. Beim Walken wurde der Stoff in einer Seifenlauge behandelt, die aus 1 Teil Öl und 4 bis 5 Teilen Alkali hergestellt worden war. Beim anschliessenden Waschen bestand die Seife aus 1 Teil Öl und 8 bis 10 Teilen Alkali. In letzterem Fall war die fettlösende Wirkung also deutlich stärker[74].

Das **ì-giš**-Öl wurde sicher auch zu 'Seifen' für die Körperpflege verarbeitet, wenn dies auch bisher nicht mit Sicherheit anhand der Texte nachzuweisen ist. Aus Mari stammen einige Texte, die über die Lieferung von **ì-giš** zum Baden von Gottheiten (*a-na ru-mu-uk* GN, RA 69, 24ff.) berichten. Da in einigen Fällen danach noch Zedernöl (**ì-giš-eren**) genannt wird, ergibt die Lieferung des **ì-giš** m.E. nur Sinn mit der Annahme, dass es - zu Seife 'verarbeitet' - zum Reinigen der Götterstatuen und das Zedernöl zum anschliessenden 'Parfümieren' (und 'Glanz-Geben') verwendet wurde. Diese Deutung wird durch ARM 21, 117:6ff. bestätigt: "**ì-giš**-Öl zum Waschen (*a-na me-si-i*) der Füsse der Götter (**gìri-dingir**).

2. Leder wird nach den Texten aus der frühen Isin-Zeit mit **ì-giš** oder auch Schweineschmalz (**ì-šah**) behandelt. Es handelt sich dabei höchstwahrscheinlich nicht um Fettgerbung, sondern um Einfetten des Leders, um es für den Gebrauch haltbarer und geschmeidiger zu machen[75]. Aus der Zeit der 3. Dynastie von Ur ist mir derzeit nur JCS 29, 122,4:4 und Nik II 438:1ff. bekannt. Danach wird Öl/Fett (**ì**) und **ì-giš** bei der Herstellung von Leder oder Ledergegenständen verbraucht. [Durch MVN 13, 895 lässt sich die Fettgerbung mit Sicherheit ausschliessen, da ein 'Lederarbeiter' (**aš$_2$gab**) in 6 Monaten nur 10 **sìla ì-giš**-Öl für die Lederverarbeitung (**kuš-aka**) verbraucht. Diese Menge würde für die Fettgerbung bei weitem nicht ausreichen.]

3. In den holzverarbeitenden Industrien verwendeten sowohl die Schreiner als auch die Schiffsbauer **ì-giš**. Der Schreiner benutzte es z.B. bei 'Stühlen' (**giš$_2$gu-za**)[76], für nicht näher bezeichnete Gerätschaften (**giš$_2$šu-kár**)[77], Wagen (**giš$_2$gigir**)[78] oder besonders häufig für Türen von Palästen und Tempeln[79]. Im Schiffbau wird **ì-giš** (einmal "gutes **ì-giš**", UET 3, 76.Rs.II.3ff.) für die Querbalken (**giš$_2$hum**)[80] von Lastschiffen und des königlichen Schiffs verwendet. Diese Querbalken mussten besondere Beanspruchungen aushalten und an ihnen wurde der Mast befestigt. Ob sie mit dem Öl eingerieben wurden, oder ob das Öl zum Tränken des Dichtmaterials, das zwischen die Ritzen gedrückt wurde, diente, muss offen bleiben. Beide Verwendungsweisen lassen sich nach Salonen 1965, 149f., nachweisen. Ausser **ì-giš** und Schweineschmalz konnte auch Fischtran beim Schiffbau benutzt werden (ibid., 149).

4. Zwei weitere Verwendungsweisen des **ì-giš** seien hier der Vollständigkeit halber erwähnt, auch wenn sie bisher m.W. nicht in Texten aus dem 3. Jahrtausend, sondern erst ab etwa 1800 v.Chr. nachweisbar sind. Danach wird **ì-giš** als Öl für Lampen ebenso gebraucht wie als Basis für Parfum (ARM 21, S. 127; ARM 23, S.416ff.). Beide Verwendungsweisen verlangen ein länger haltbares Öl, das nicht so rasch eintrocknet wie Leinöl.

Fasst man die technischen Verwendungsweisen des **ì-giš**-Öls zusammen, so ergibt sich Folgendes: Die technischen Eigenschaften des **ì-giš** scheinen dem Schweineschmalz ähnlich, denn es kann sowohl in der Textilindustrie, als auch in der Leder- und Holz-verarbeitenden Industrie durch Schweineschmalz ersetzt werden.

Bevor ich zur Diskussion übergehe, ob **še-giš-ì** wirklich Sesam(körner) und **ì-giš** Sesamöl sind oder nicht, müssen noch die vorkommenden Qualitäten besprochen werden. **Še-giš-ì** wird erst ab etwa 1800 v.Chr.[81] in Qualitäten eingeteilt, nicht aber m.W. in den Texten des 3. Jahrtausends. Die normale Bezeichnung des Öls ist **ì-giš**. Das "gute **ì-giš**" (**ì-giš-du$_{10}$-ga**) begegnet weitaus seltener und kommt nur in relativ geringen Mengen vor[82]. In den Texten findet man die beiden Qualitäten in der Regel in folgender Anordnung[83]:

ì-nun-du$_{10}$-ga	"gutes Butterschmalz"
ì-giš-du$_{10}$-ga	"gutes **ì-giš**-Öl"
ì-nun	"Butterschmalz"
ì-giš	"**ì-giš**-Öl"

Nach dieser Einordnung zu urteilen, wird Butterschmalz höher eingeschätzt als **ì-giš**. Dies wird durch die Preise bestätigt (s. oben). Für 1 Sekel Silber konnte man meist 12 **sìla ì-giš**, aber nur 10 **sìla** Butterschmalz und sogar nur 5 **sìla** "gutes Öl/Fett" erwerben. Da das "gute **ì-giš**" nur in geringen Mengen anfällt und sicher von höherem Wert war, handelt es sich dabei wahrscheinlich um das erste Öl, das bei der Ölgewinnung abtropft. Man könnte dazu das 'olio vergine', das "Jungfernöl", vergleichen, das nach dem Mahlen der Oliven abläuft.

Leider geht aus den Texten des 3. Jahrtausends nicht hervor, auf welche Weise man die Körner zerkleinerte und das Öl herauslöste. Die Zerkleinerung der Körner könnte in einem Mörser mit Hilfe eines Stössels oder in einer Handmühle erfolgt sein (vgl. dazu den Beitrag von M. Stol). Für das Trennen des Öls von den festen Kornteilen gibt es wiederum zwei Möglichkeiten: 1. durch Pressen des entstandenen Öl-Breis z.B. durch ein Tuch oder 2. durch das Hinzufügen von warmem Wasser, wobei nach dem Kneten der Masse das Öl aufsteigt und abgeschöpft wird. Diese Methode hat G. Dalman in Palästina[84] beobachtet. Auf ein Pressen durch ein Tuch könnte möglicherweise der Terminus **bára-aka** oder **bára-ga** hinweisen[85], der mehrfach auf **ì-giš**, bzw. **še-giš-ì** folgt. Dieses **bára-aka/ga** ist in lexikalischen Listen mit *halṣu* geglichen, was W. von Soden in AHw (313 *halṣu* I 1-2) als "ausgepresst" und CAD (H 50) mit "pressed out (said of sesame seeds)" deuten (s. dazu ausführlicher den Beitrag von M. Stol). Man könnte sich vorstellen, dass man den Brei in einen Sack oder ein Tuch füllte und dann so lange presste, bis kein Öl mehr abtropfte. Die Ölausbeute dürfte bei diesem Verfahren nicht allzu gross gewesen sein. Das mit **bára-aka/ga** bezeichnete Öl erfreute sich ganz offensichtlich hoher Wertschätzung, denn einmal quittiert der Stadtfürst selbst den Empfang, das andere Mal ist das Öl für das königliche Fest des 'Bierausgiessens' in Tummal bestimmt[86]. Worin sich das **ì-giš-bára-aka** von dem **ì-giš-du$_{10}$-ga** unterscheidet, lässt sich derzeit nicht feststellen. Mit ziemlicher sicherheit scheint **ì-giš-du$_{10}$-ga** kein anderer Terminus für **ì-giš-bára-aka**.

Nur ein geringer Teil des **še-giš-ì** wurde ganz offensichtlich dem **bára-aka** genannten Ölgewinnungsverfahren unterzogen, denn die höchste genannte Quantität ist 39 **sìla** (c. 32,8 Liter, s. Text 2 BM 14297:1-8) dafür ausgegeben. Die höchste Menge an **ì-giš-bára-aka** beträgt nur 3,5 **sìla** (ca. 2,9 Liter, AfO 24 Tf. XIX Truro 4:1). Nach Text 2 erhalten Frauen wohl täglich (der Text ist auf den Tag datiert, was in Lagaš äusserst selten und daher von besonderer Bedeutung ist) 5 oder 6 **sìla še-giš-ì**. Mehr konnten sie offenbar nicht an einem Tag verarbeiten[87]. Die weitaus grösste Menge des **še-giš-ì** wurde dem normalen Ölgewinnungsverfahren, das wohl mit **sur** bezeichnet wurde, zugeführt. Interessanterweise gibt es auch - wie M. Stol gezeigt hat - nach den altbabylonischen Texten zwei Gewinnungsverfahren: das seltenere *halāṣu* und das übliche *ṣahātu*. Nach YOS 2, 58 = AbB 9, 58:8ff. könnte es sogar sein, dass die Ölsamen beiden Verfahren nacheinander unterzogen werden konnten (erst *halāṣu*, dann *ṣahātu*). In diese Richtung lässt sich wohl auch CT 8, 8e:1f. und 9f. (9 **gur še-giš-ì, bára-ga** *ša-lu-uš-ti* **ì-giš**; *a-na* **itu-1-kam še-giš-ì** *i-ṣa-ha-tu-ma*) interpretieren.

Nach den Texten aus der Zeit der 3. Dynastie von Ur gibt es noch weitere Qualitätsbezeichnungen bei **ì-giš** und **ì-giš-du$_{10}$-ga**. Als Beispiel sei UET 3, 1017:7ff. aufgeführt; in diesem Text findet man Öle und Fette in folgender Reihenfolge[88]:

ì-giš-du$_{10}$-ga giš a-rá-6	"gutes **ì-giš**-Öl, Holz/Holzgerät	6mal (benutzt)"
" " " " " " -3	"gutes **ì-giš**-Öl, Holz/Holzgerät	3mal (benutzt)"
ì-nun-" " " " " -3	"gutes Butterschmalz, Holz/Holzgerät	3mal (benutzt)"
ì-giš-" " " " " -1	"gutes **ì-giš**-Öl, Holz/Holzgerät	1mal (benutzt)"
ì-nun-" " " " " -1	"gutes Butterschmalz, Holz/Holzgerät	1mal (benutzt)"
ì-giš-" " ----------	"gutes **ì-giš**-Öl"	

Am Anfang des Textes steht wieder die beste, am Ende die schlechtere Qualität. Das gute **ì-giš**-Öl, das auf irgendeine Weise sechsmal bearbeitet wurde, ist folglich das hochwertigste Öl. Leider bleibt völlig im unklaren, welches Holzgerät für diesen Prozess verwendet wurde. Wichtig scheint mir, dass auch das **ì-nun**, das ich vorläufig mit "Butterschmalz"[89] übersetzen möchte, diesem Prozess unterzogen wurde. Welchen Reinigungs- oder Verarbeitungsvorgang kann man sowohl an einem tierischen als auch an einem pflanzlichen Öl, bzw. Fett durchführen? Sollte es sich um irgendeinen Reinigungs- oder Raffinations-Prozess handeln?

Für die Deutung wichtig ist noch, dass dabei ein Verlust entsteht: Amherst 50 IV 10f.:

> **šu-nigín 5 sìla ì-giš giš a-rá-2, izi-kú-bi ½ sìla**
> "insgesamt 5 **sìla** (=ca. 4,2 Liter) **ì-giš**-Öl, Holz/Holzgerät zweimal (benutzt), der dabei (entstehende) Verlust: ½ **sìla** (= ca. 0,42 Liter)".

Hier entstand also ein Verlust von fast 9,1%. Bei sechsmaliger Anwendung dieses Holzgeräts dürfte der Verlust noch deutlich höher gelegen haben. Bei diesem Verlust handelt es sich nicht etwa um Pressrückstände oder ähnliches - diese heissen **duh-(še-)giš-ì** - sondern um tatsächliche Verluste, bzw. nicht mehr verwendbare Rückstände am Gerät oder Gefäss. Man nahm also Verluste in Kauf, um eine bessere Öl- oder Fettqualität zu erzielen. Der Vorgang konnte bis zu sechsmal wiederholt werden.

Der Vollständigkeit halber seien noch 2 Bezeichnungen angeführt, die jeweils nur einmal vorkommen: 1. **ì-giš ì-**ŠID (NATN 556:1) und 2. **ì-giš-sù** (vor **su$_{11}$-lum-sù** TU 128 V 6). Beide Bezeichnungen vermag ich nicht zu deuten.

Nun kurz eine Zusammenfassung der wichtigsten Ergebnisse: **giš-ì** war eine Sommerpflanze, die wohl auf bewässertem Feld bei der grossen sommerlichen Hitze des Iraq besonders gut gedieh. Aus dem Samen gewann man in der Regel 20% Öl, die Pressrückstände dienten Menschen und Tier als Nahrung. Das Öl war offenbar - trotz der Hitze - über mehrere Wochen haltbar, ein sehr gutes Speiseöl, das zum Backen und Herstellen anderer Speisen Verwendung fand. In der Industrie diente es zur Herstellung von Seifen, Leder wurde damit behandelt und allerlei Holzgegenstände und Schiffsteile.

Bei den Samen lassen sich bisher keine Qualitätsunterschiede feststellen, wohl aber beim Öl, das verschiedenen Prozessen, die Möglicherweise der Reinigung dienten, unterworfen wurde. Bei diesem Arbeitsgang entstanden Verluste.

Abschliessend muss die Frage diskutiert werden, ob **giš-ì**, **še-giš-ì** und **ì-giš**, Sesam, bzw. Sesamöl oder Flachs/Lein, bzw. Leinöl ist. Jean-Pierre Grégoire stellte einmal die Frage, ob es nicht sein könne, dass man in Mesopotamien den Faserlein mit **gu**, den Öllein aber mit **giš-ì**, bzw. **še-giš-ì** bezeichnete. Gegen diese im ersten Moment sehr verlockende These gibt es m.E. gewichtige Argumente:

1. wird **gu**, also Flachs, im Winter und **giš-ì** in Hochsommer angebaut.
2. gehören der Flachsanbau und der **giš-ì**-Anbau zu ganz anderen Organisationen. Die Flachsbauern heissen **engar-gu** und die **giš-ì**-Bauern **engar-(še-)giš-ì.**
3. beim Anbau des Faserleins müsste man die Samenkapseln und beim Anbau des Öllein die Stengel mit den Fasern weggeworfen haben, denn es sind weder Öl der **gu**-Planze noch Fasern der **giš-ì**-Planze bezeugt. Eine solche Verschwendung von Rohmaterialien halte ich für kaum denkbar besonders da Faser- und Öllein den Boden sehr auszehrten und man ihn nur in mehrjährigen Abständen auf demselben Feld anbauen kann[90].
4. ist Leinöl kein gutes Speiseöl, sondern wird rasch ranzig und trocknet relativ schnell ein. **ì-giš**-Öl war aber länger haltbar und ein vielseitig verwendbares Speiseöl.
5. Die einzige Verwendung von **ì-giš**, die eventuell für eine Deutung als Leinöl sprechen könnte, wäre die häufige Anwendung auf Holz. Leinöl bildet auf Holz in wenigen Tagen einen wasserfesten, undurchlässigen Film, wie er gerade für Türen oder Schiffsteile

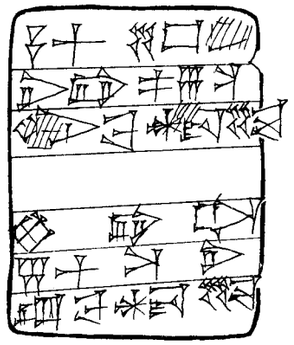
geeignet wäre. Dieser Deutung widerspricht aber eindeutig im technischen Bereich, die Austauschbarkeit des **ì-giš** mit dem billigeren Schweineschmalz.

Für eine Deutung von **giš-ì, še-giš-ì** und **ì-giš** als Flachs/Lein, Leinsamen und Leinöl gibt es also m.E. überhaupt keine gewichtigen Gründe. **Giš-ì** ist nach meiner Überzeugung mit Sicherheit nicht "Flachs/Lein", sondern eine andere Pflanze mit sehr ölhaltigen Samen. Dafür kommt - soweit mir bekannt - nur Sesam in Frage, besonders da es aus philologischer und technologischer Sicht m.W. nur Argumente gibt, die für Sesam und Sesamöl sprechen, nicht aber eindeutig dagegen. Wohl das gewichtigste Argument für Sesam ist der Anbau im Sommer, was m.W. die anderen Ölpflanzen und ganz besonders Lein ausschliesst.

Texte[91]

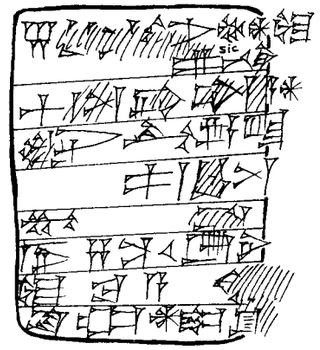
1. BM 14134 (Ur III, Herkunft: Girsu, Datum -/III)

Vs.



1) 0.2.1 **še-giš-˹ì˺ (gur)**
2) **ì-bi 0.0.2 6 sìla (gur)**
3) **gìri ba-an-da-ku$_4$**[92]
   (unbeschriebene Zeile)
4) **šà-bi-ta**
5) 5½ **sìla ì**
6) **kišib ba-an-da-ku$_4$**

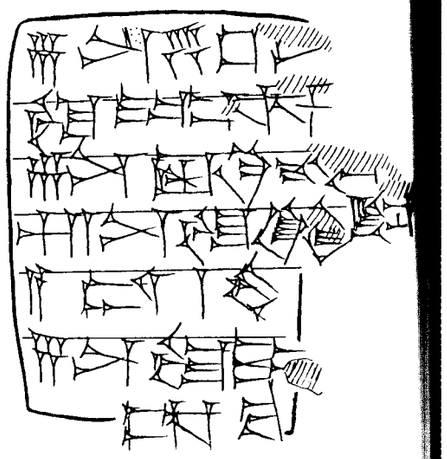
Rs.



7) 5 ˹1/3 **sìla**˺ **gìri géme-^{d}nin-MAR!.KI(?)**[93]
8) 0.0.1 1 **sìla (gur) dug-bi 1-àm**
9) **gìri šeš-kal-la**
10) 0.0.2 i ˹5/6˺ **sìla (gur)**
11) **mu-TÚM**
12) **lá-ì** 4 **sìla** 10 **gín ì**
13) **nin-ba-a-l[u]l**[94]
14) **itu-ezen-^{d}li$_9$-si$_4$**

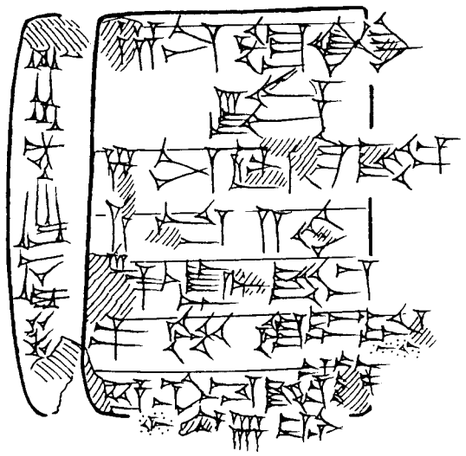
2. BM 14297 (Ur III, Herkunft: Girsu, Datum: IS 2/II [8])

Vs.



1) 6 **sìla še-giš-ì**
2) **nin-dumu-ab-ba**
3) 6 **sìla ama-DI.˹NE˺**
4) 0.0.1 2 **sìla (gur) nin-ki-HAR-ša$_6$**
5) **a-rá-1-kam**
6) 5 **sìla nin-dumu-ab-ba**

Rs.



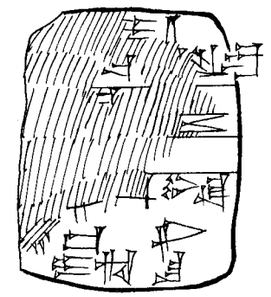
7) 5 **sìla nin-ki-HAR-ša$_6$**
8) 5 **sìla ama-DI.NE**
9) **a-rá-2-kam**
10) **[bá]ra-aka-dè**
11) **ugula géme-nin-bàn-da**
12) **itu-GU$_4$-DU.NE.S[A]R, u$_4$-8 ba-zal**
13) **mu-ús-sa** *^{d}i-b[i]-^{d}s[în]*

3. BM 14179 (altbabylonisch, Herkunft: unbekannt, ohne Datum)

Vs.

1) 1.1.0 **gur še-giš-ì**
2) *iš-me-i-a*, **dumu** *ra-'a$_4$-bi*[95]
3) *ù ^{d}sîn-šar-ru-um*
4) **dumu** ‹*i*›*-pî-iq-nu-nu*
5) 0.4.0 **(gur) še-giš-ì**

Rs.



6) [*iš-me*]-˹*i*˺*-a*, [*ù ^{d}sî*]*n*-[*ša*]*r-ru-um*
7) [ ] x [-TU]M[96]
   (unbeschriebene Zeile)
8) [ ] x x **-in^{ki}**[97], **˹še˺-giš-ì**, *i-ri-šu*

ANMERKUNGEN

1 G. Pettinato, *Ebla* S. 174 und 208 (TM 75 G 1767) = SEb 2, 7f. = B. Foster, BiOr 40, 300 mit Anm. 4; ARET 3, S.353 s.v. **giš-ì-giš.** B. Foster, BiOr 40, 300 lehnt ohne Begründung, die bisher allgemein akzeptierte Übersetzung "Olivenbaum" ab, ohne einen neuen Deutungsvorschlag zu machen. Die Übersetzung "Olivenbaum" ist aber zwingend, wenn man die für den Gersteanbau verwendeten Feldflächen vergleicht. Nach ARET 2, 26 reichen 7000 **gána.**KI für die Versorgung der Stadt, 720 für die Gersterationen und 3600 **gána.**KI für die Versorgung des Verwaltungszentrums (vgl. ARET 2, 27 und 27a). Daher muss **gána.**KI ein relative grosses Flächenmass bezeichnen. Vergleicht man nun, dass nur etwa 1 - 2 **giš-ì(-giš)**-Pflanzen auf so einer Fläche stehen, so kann es sich einzig um Bäume handeln. Von den Früchten dieser Bäume stammt das einzige Öl, das m.W. in den Ebla-Texten erwähnt wird. Damit stimmt auch die These F. Pomponio's (*Orientalia Lovaniensia Periodica* 14 [1983] 8f., 12) überein, dass 1 **gána**-KEŠDA von Ebla in etwa 1/10 eines mesopotamischen **iku** entspricht (1 **iku** = ca. 3600 m^2, 1 **gána**-KEŠDA demnach ca. 360 m^2, also eine Fläche von ca. 19 x 19 Metern).

2 Z.B. ARET 3,104 passim.

3 Vgl. MEE 2, S.16f.; ARET 3, S.358 sv. **ì-giš.**

4 RTC 216:1. - Zum Verbreitungsgebiet der wilden Vorläuferin der Olive (*Olea sativa*) s. P. P. Vértesalji, *Babylonien zur Kupfersteinzeit* [Beihefte zum Tübinger Atlas des Vorderen Orients, Reihe B (Geisteswissenschaften) Nr. 35, Wiesbaden 1984], 179.

5 AHw 1037; aus Babylon: VS 22, 83:40 **ì-giš** *se-er-du-um.*

6 MAD 3, 283 *ŠQD.*

7 Nach Fischer 1948, 49, Ölanteil zwischen 40 und 50%.

8 Belege s. MAD 3, 282 *ŠQD*, BIN 8, 296:1 (dazu Foster, USP 122 mit Anm. 79), 318:3, 339:3, MVN 10, 228:2 = RA 73, 30,24.

9 S. USP S. 120f., RTC 109:5 und AHw, CAD s.v. ***erēnu.*** Für 'parfümiertes' Öl könnte VS 22,84:22 (aB) **ì-giš** *e-re-ni* und RA 69, 26 sprechen, vgl. **ì-giš** *šu-úr-man* ARM 22, 269:1.

10 RlA 6, Leinen § 1.

11 ATU Zeichen 401+402, Texte 617 II 4, 624 II 4, 625 I 2, 629 I 2f., 643 I 2, 649 I 2 und z.B. W.21671 (unpubliziert).

12 RlA 6, Leinen § 3.

13 RlA 6, Leinen § 8 und AHw, CAD s.v. *kitû.*

14 USP 35:3,7,8,10,12 usw.; 36:1,5,7,10 usw., s. dazu ibid. S.111 d.

15 B. Foster, USP S.111 d schreibt zu **ninda-gu** "perhaps a kind of bread made with chick peas", ähnlich AOS 32 E 29. Nach HLC 1,14,271:1ff. muss es sich aber um eine Gerstemehlsorte handeln, da eine Lieferung von Gerste als "für (Herstellung) von gutem **gu**-Mehl" bezeichnet wird.

16 MVN 7, 95.Rs.1f., TMHNF 1-2, 163:1ff.

17 AnOr 1,164:1ff.

17a Vgl. Dalman 1932, 188,298f.

18 RlA 6, Leinen § 4b.

19 Vgl. **ki-mun-gazi** ASJ 3,60,9 I 9; **ki-sum(-ma)** St Pohl 9 S.616, **ki-gú-gal**, **ki-ú-^{d}iškur** usw. YOS 4,307:4,6,8. S. unten zu **ki-giš-ì** mit Anm. 24.

20 Z.B. Dalman 1932, S.298f. nennt keine alte Verwendung von Flachs für die Ölgewinnung, nur modern, s. S.355.

21 Fischer 1948, S.31: Faserlein 30-38%, Öllein 38-44%.

22 Fischer 1948, S.32, 67.

23 Z.B. RTC 127 VIII 16, ITT 2,5742:1.

24 Z.B. Belege aus Girsu: aAk ITT 1,1379:4; Ur III CT 7,32,18394:5,8 (mit Pflugrindern), ITT 5,7684 = TCS 1,356 (Opfer), MVN 9,72:4 (mit **še-giš-ì** als Saatgut?), HLC 3,141,373 III 7. Umma: BIN 5,272:194.

25 S. oben Anm. 19.

26 Z.B. AAS 177:4, RTC 353:7, TCS 1,258:5.

27 Z.B. AJSL 29,1912-13, 126ff. Nr.3 = RA 57,197, 51, Lau 148:2, RA 58, 1964, 101, 48, YOS 4,290:11.

28 TCS 1,135:4+8. E. Sollberger interpretiert andere Textstellen, an denen **giš-ì** genannt wird, abweichend: S.122:249 GIŠ.NI "a kind of wool?".

29 Ferner NATN 511:1, MVN 11, L 18, vielleicht noch in Feldnamen **a-šà-giš-ì-gaba-x-li** UNL 1/1, Nr. 393 = MVN 11,90:8.

30 AAS 135 VII 13, ASJ 4,119, 19.III.25, TJA pl. 56, IOS 26:3, IOS 29:3, UCP 9,200,78:25.

31 S. dazu JAOS 88, 115a.

32 Zu **kù** und **kù-luh(-ha)** s. z.B. BIN 8, 10 I 1, 46:11, RTC 27 I 1, ZA 72, 175, 14, MVN 3, 10.II.1', VI.1', MVN 10, 82 I 1, 4, 83 I 1, 85 I 1, 4; SR S.222 und FAOS 6, 203ff.; zu **kù-babbar** ibid. S.206, 321; OIP 99, S.49:95 (Abu Salabikh).

33 CT 50, 70:1, 72:1, 73.I.2+4, 78:2, BIN 8, 144:19, 156:16, ITT 2, pl. 76 4598:1, MVN 3,1 I 1, VII 8', 97 I 1, 102:1, Or 51, 1982, 355 I 9, II 3, 363:1.

34 Z.B. RTC 127 VIII 16 und s. Belege bei B. Foster, USP S. 119 und zur Datierung S. 156 und P. Michalowski, RA 75, 1981, 173ff.

35 Vgl. dazu auch I. J. Gelb, JAOS 87, 3b, dessen Feststellung mir Dr. Gebhard Selz, Freiburg, freundlicherweise bestätigte. Ihm ist kein präsargonischer Beleg aus Lagaš bekannt.

36 In altbabylonischer Zeit gab es grosse Anbaugebiete im Königreich Mari, s. ARM 22, 276 und ARM 21, S. 128f.

37 MVN 3, 299:1+4; H. Sauren, TCE 264 A+B 1+5 und vgl. MVN 3, 298 und 305. Stets liefert Guzana **še-giš-ì**.

38 RépGeo 2, S. 91, RépGeo 3, S. 131.

39 In Susa sind relativ viele Texte, die sich auf **še-giš-ì** oder **ì-giš** beziehen, gefunden worden, z.B. MDP 10, 73, 125:1; MDP 14, 68,7:3,5; MDP 18, 25f., 83, 86; 34ff., 109, 114, 122; MDP 28, 121ff., 504-509; ihre Datierung ist zum Teil schwierig, die ältesten stammen aber höchstwahrscheinlich aus der Zeit der Akkad-Dynastie.

40 MVN 3, 299:1 (Umrechnung mit 1 **sìla** = 0,842 Liter).

41 MVN 3, 347:12 116 Kor, MVN 7,460:1 120 Kor, TCS 1, 135:4 135 Kor und HSS 4,3.I.4 197 Kor.

42 UET 3, 1129 Rs. 11+13 zusammen 470 **gur** 3 2/3 **sìla**.

43 MVN 12, 400:1f., Lau 102:1ff.; dazu wohl auch MVN 11 L 18: Ein Bote ist mit **giš-ì** unterwegs, er bringt wahrscheinlich Saatgut an seinen Zielort.

44 ASJ 2, 28, 82:1ff., MVN 3, 305:5ff. mit **itu-kur-ga-na-še**, der nicht genau bestimmbar ist.

45 S. die Anm. 43-44 erwähnten Texte.

46 S. Beitrag von M. Stol Anm. 7.

47 MVN 12, 15:3 6 **še gur-lugal, á-hun-gá, ki-giš-ì-ka giš-gi-ú-zé.**

48 Genannt werden **(še-)giš-ì** oder Pressrückstände (**duh-giš-ì**): Amherst 83 = RA 54, 124, 13; RA 58, 101, 48; 105, 90; MVN 5,266; RTC 192; UET 3, 944.

49 S. NATN 236:1ff. (Lieferung von **še-giš-ì** von einem Feld).

50 Zur Wachstumszeit s. JAOS 88, 118f., K. Butz, OLA 5, 386 und in vorliegendem Band den Beitrag von D. Bedigian.

51 Die genaue Bedeutung des Terminus (**še**)**-giš-è-a** ist noch nicht geklärt, ich halte "Sieben" (einschliesslich Worfeln?) für die wahrscheinlichste, da z.B. auch Hülsenfrüchte (**gú**, MVN 12, 157:32f.) dieser Behandlung unterzogen werden (anders AAS S. 128ff.). 52 JAOS 88, 117ff.

53 MVN 5,155 III 5 f., HSS 4,3 IX 19f., Amherst 50 I 6f. und Text 1 (BM 14134):1f. Vgl. zu den altbabylonischen Belegen M. Stol, AbB 9, S. 43 Anm. a zu 58 und UET 5,595:1 mit 24,16%, TEBA 14:19f. mit 20, bzw. 25%, BIN 7, 158:11f. mit 20%.

54 Christian Gottfried Whistling, *Oekonomische Pflanzenkunde für Land- und Hauswirte, Gärtner, Künstler usw., 3. Theil*, Leipzig 1806, Die Oel= Spinn= Färbe= Gerbe= und Fabrikpflanzen S. 243: aus 9 Pfund Samen einen Ölertrag von 2 Pfund oder "nach anderer Quelle" aus 2 Pfund ½ Pfund Ölertrag.

55 1948, S.59f. und in vorliegendem Band den Beitrag von D. Bedigian.

56 Z.B. CT 3, 20 VII 28 - VIII 3, STA 2 IV 4, TU 101 IV 15; **géme-ì-sur** ITT 2, 766, ITT 5, 9863, UET 3, 1077 II 13, 1413:3, 1443:6.

57 UET 3, 762:2.

58 UET 3, 1465:4. Möglicherweise gehört noch MVN 1, 208:2 **nì-sur engar-še-giš-ì-ka-ke$_4$-ne** hierher.

59 NCT 44:214f. (60 **sìla**), UCP 9, 199, 78:19 (60 **sìla**), TLB 3, 152:4f., 10f. (100 **sìla**), NATN 694:1f. (90 **sìla**). Auf ca. 84 **sìla** kommt man bei Vergleich von UET 3, 1103:5f. (Preis in Datteln) mit 1083 und 1084. Vgl. dazu den Preis aus der Isin-Larsa-Zeit TCL 10, 17:3ff. = Jean, Larsa 127 (Rîmsîn 2) mit 75 **sìla**.

60 TU 122 VI 10f. (9 **sìla**), Amherst 50 IV 16 und HSS 4,3 XI 9f. (je 12 **sìla**). Nippur: NATN 563 Rs. 3 (9 **sìla**), 160:11f. (12 **sìla**). Unbekannter Herkunft: UDT 179:1f. (12 **sìla**). Zu den altbabylonischen Preisen s. ARDer S. 40 mit Anm. 7; nach W 20472,88:10ff., 15ff. konnte man für 1 Sekel Silber in Uruk 7,08 **sìla ì-giš**, bzw. 12 **sìla** Schweineschmalz erwerben. Mittelbabylonisch s. V. Donbaz, JNES 41, 207:16f. und 208:32f.

61 MVN 1, 240 II 6f.

62 MVN 3, 343:10.

63 UET 3, 1165:1ff., 1201 I 4f., Rs. III 3.

64 S. LaP S. 151ff.

65 Z.B. ITT 2, 4097:2, 5, 10 (Prinzessin), TCS 1, 179:4, RA 58, 105, 88, TU 164^{19}:11ff, UET 3, 1633:2f.; Opfer z.B. ITT 2, 819:1ff., 829:1, 3175:1, 3213:3; ITT 3, 6061:1, 6172:1; Umma: Or 47-49, 442:1, YOS 4, 299:8; Ur: UET 3, 251:1, 252:1f., 255:1f.

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66 MVN 2, 16:1f.; ITT 2, 2601:1-5; UET 3, 1427:1-7.

67 Bisher m.W. nicht explizit in einem Text, doch anzunehmen, da auch **še-giš-ì** als Öl/Fett-Ration (**ì-ba**) ausgegeben wird, z.B. RA 54, 126, 19, RA 58, 105, 90.

68 CT 5, 48 IV 18 (diesen Hinweis danke ich J.-P. Grégoire).

69 AnOr 1, 40:14 (**ì-giš ninda-aka-dè**).

70 MVN 3, 311:1f., Or 47-49, 295:6f., 11, 14ff., UET 3, 1149:5f.

71 UET 3, 1130:1ff., vgl. 1181:8f.

72 Nach H. Sauren, TUU 10 Anm. 31.

73 UET 3, 1766:3'f.

74 UNT S. 159, 162f., 169ff.

75 M. Stol, RlA 6, Leder § 25.

76 ITT 3, 4948:1f.

77 UET 3, 281 Rs. 10ff., 1145:1ff., 1175:1ff.

78 Orient 16, 83, 122:1ff., vgl. ibid. S. 77, 112 III 79f. Schweineschmalz um einen Wagen "schön zu machen" ($\check{s}a_6$).

79 ITT 3, 4948:1ff., 4964:1ff., JCS 29, 122, 4:1+4, RA 58, 103, 67:1f., UET 3, 281 Rs. 10ff., 1145:1ff., 1175:1ff.

80 MVN 9, 63:1ff., UET 3, 76 Rs. II 4ff. Zu **giš$_{hum}$** s. Salonen 1939, S.94. **ì-giš** für Schiffe (zum Teil wohl als Opfer) NFT 185 AO 4200:1ff., *Orient* 16, 77, 112 I 12ff. Schweineschmalz und **ì-giš** für Nägel(?) AfO 24 Tf. XIX Truro 4:1ff. und der sehr ähnliche Text AOS 32 P 21 = H. Sauren, TCE 269:1ff.

81 S. Z.B. ARM 22, 276 IV 16-26.

82 UET 3, 1511:7 6 Kor; meist aber nur einige **šìla** oder **gín** (= 1/60 **šìla**): ibid. 76 Rs. II 3, HLC 2, 62, 23 VI 6f., ITT 3, 5155:7, STA 8 IV 6, XIV 12 **ì-giš**: HSS 4,3 II 2 über 64 Kor.

83 Lagaš: HSS 4,5 II 17ff., RTC 304 II 11ff., TU 126 IV 24ff.; Umma: AnOr 7,303:90ff.; Ur: UET 3, 95:1f. Werden **ì-nun-du$_{10}$-ga** und **ì-giš-du$_{10}$-ga** in einer Abrechnung summiert, so wird als gemeinsamer Terminus **ì-du$_{10}$-ga-hi-a** "verschiedenes gutes Öl/Fett" verwendet (HSS 4, 5.II.19ff. + VI.10).

84 1932, 296f.

85 AOS 32 S. 129 P 21 a und M. Sigrist, JCS 29, 175 zu Z. 35.

86 AOS 32 P 21 = H. Sauren, TCE 269:1ff., AfO 24 Tf. XIX Truro 4:1ff., HSS 4, 3.V.15ff.

87 Vgl. dazu den altbabylonischen Text YOS 5, 93:1ff.

88 Ähnlich UET 3, 1051:1ff., 1153:1f. und besonders UET 9, 1370 I 1ff.; **ì-giš a-rá**-1 MVN 7, 162 Rs. 1.

89 K. Butz, WZKM 65/66, 37.

90 RlA 6, Leinen § 4a.

91 Den Trustees of the British Museum und Herrn T.C. Mitchell danke ich für die Publikationserlaubnis für diese 3 Texte. Herr C.B.F. Walker kollationierte noch einige Zeichen, wofür ich ihm ganz herzlich Dank sage.

92 Eine Lesung **ba-an-da-tu** und Deutung "Er/Sie wurde mit ihm/ihr geboren/erschaffen" ist ebenfalls möglich.

93 So wohl zu lesen, da andere Möglichkeiten **-^{d}nin-ú$^{!?}$-na** oder **-^{d}nin-ú$^{!?}$-rum^{ki}** (vgl. **urum$_x$(Ú.A.HA)^{ki}** s. JCS 33 [1981] 56) m.W. ohne jede Parallele wären.

94 Möglich wäre auch eine Lesung **nin-ba-a n[a]r** ("Sängerin" aber schwierig wegen des Kontextes) oder **nin-ba-a-ka[m]** (wogegen das Formular derartiger Texte spricht).

95 Vgl. PN *ra''ābum* UET 5, 385:7 = AHw 933. Nach freundlicher Mitteilung von M. Stol (Brief vom 24.9.1984) liegt aber an der in AHw genannten Stelle der Ortsname URU^{ki} *ra-HA-bu-um* vor (ein mit PN gebildeter Ortsname?).

96 Z. 5-7 entweder Nominalsatz oder Z.7 etwa [*i-ṣa-ha-t*]*u$_4$* zu ergänzen? (Vorschlag von M. Stol; für TUM = *tu$_4$* nannte er folgende aB Belege: AbB 7,125 Rs. 16, TCL 17, 34:24, UET 6, 396:2, 19).

97 Ergänzung zu [ ]⌜**ì$^{?}$-si$^{?}$**⌝**-in^{ki}** nach den Spuren nicht völlig auszuschliessen.

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CULTIVATION OF LEGUMES AND MUN-GAZI PLANTS IN UR III GIRSU*

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I. The agricultural regime after *TuT* 5 (Shulgi 47)

I.1 The purpose of this article is to study the cultivation methods of legumes ("big pulses" **gú-gal-(gal)** and "small pulses" **gú-tur(-tur)**) and the **mun-gazi** class of plants such as coriander (**še-lú**) in Girsu in the Ur III period (ca. 2100-2000 B.C.). In order to obtain an introductory understanding of agriculture in Ur III Girsu, however, I should first like to refer to Reisner, *TuT* 5. The text, which I have already presented as Table 1 in my *BSA* article [Maekawa 1984, 90-91], is indeed one of the best source materials for a bird's-eye view of Ur III land management.

TuT 5 records the total area of the domain land (**gán-gu$_4$**) which various public institutions of Girsu (i.e. "temple" and other establishments under the direct control of the governor of Girsu) cultivated in the 47th regnal year of Shulgi. The grand total of cultivated area reaches **3,744 bùr 14½ iku** (24,266 ha.; 1 **bùr**[=18 **iku**]= approx. 6.48 ha.), and approximately the same area of land was probably left unseeded in Shulgi 47 under the system of alternate-year fallowing of winter crops. In addition to the domain land (**gán-gu$_4$**) the management of which is recorded in *TuT* 5, the other two types of public land, i.e. the land allotted to the personnel of public institutions (**gán-ŠUKU**) and the tenant land leased out to the personnel (**gán apin-lá/gán níg-gál-la**), must have existed extensively in Ur III Girsu. My present opinion is that the public land of Girsu was several times as extensive as that of the neighboring province of Umma.

According to *TuT* 5, barley was planted in the Girsu domain land of **3,664 bùr 2½ iku** (23,744 ha.), which occupies 97.8% of the total area of land under cultivation in Shulgi 47, while emmer plots and wheat plots were respectively **64 bùr** (415 ha.: 1.7%) and **5 bùr 12 iku** (37 ha.: 0.15%) in area. So, *TuT* 5 has been quoted by Jacobsen and me as evidence for intensifying salinization of land in the Ur III period [Jacobsen & Adams 1958, 1252; Jacobsen 1982, 16, 30, 53; Maekawa 1974, 41; 1984, 81, 88].

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I.2 *TuT* 5 classifies the cultivated plots into eight categories according to the different amounts of cereals to be consumed per unit area (**bùr**). For example, barley plots are classified into three: "plots of 1 **gur** 150 **sìla** (=1.5 **gur**) of barley per **bùr**" (Category A), "plots of 1 **gur** 240 **sìla** (=1.8 **gur**) of barley per **bùr**" (Category B) and "plots of 1 **gur** 60 **sìla** (=1.2 **gur**) of barley per **bùr**" (Category C) [1 **gur** = 300 **sìla**, 1 **sìla** = approx. 1 litre]. As for the first two types of plot, each amount points to the barley which is to be required as seed (**še-numun**) and animal fodder (**mur-gu$_4$**) for sowing one **bùr** of land. This is why I have given the name "seed-and-fodder texts" to a group of Girsu agricultural documents the best example of which is *TuT* 5 [Maekawa 1984, 76ff.]. In Category C plots, on the other hand, 1.2 **gur** of barley was solely consumed as seed.

TuT 5 gives the generic name **(gán) ki mun-gazi** to the plots of 11 **bùr** (71 ha.) which were exclusively managed by the personnel of the "temple" of Ningirsu (Category H plots; *TuT* 5 Obv. I.7-8: **11 (bùr) gán ki mun-gazi 0.2.3.0-ta, še-bi 5.2.3.0 gur**). According to the text, barley was consumed at the rate of 0.5 **gur** (=150 **sìla**) per **bùr** for Category H plots. I conclude that this amount of barley was given to plow animals, and in fact, BM 12309 (Maekawa 1981, Text 9), calculates the animal fodder (**mur**) for sowing the plot named **(gán) ki mun-gazi** at the rate of 0.5 **gur** per **bùr**.

My assumption is that legumes (**gú-gal(-gal)** : *hallūru*, "big pulses"; **gú-tur(-tur)** : *kakkû*, "small pulses") were cultivated as well as other plants such as coriander (**še-lú** : *kisibirru*) in the **mun-gazi** plots in Ur III Girsu.

II. The term mun-gazi

II.1 Oppenheim assumed that the element **gazi** in the term **mun-gazi** describes a "special quality of salt (**mun**)", while admitting that **gazi** (*kasû*) usually denotes an "odoriferous plant of still unidentified nature" (= cassia ?). Oppenheim interpreted the term **ki mun-gazi** in *TuT* 5 as "territory (covered with) salt dust" [Oppenheim 1948, 7].

According to Landsberger, **gazi** (*kasû*) means mustard and **mun-gazi** (literally "salt - mustard") is a generic term for spices. He interpreted the passage in question in *TuT* 5 as "(11 **bùr** of) field where spice plants grow (with little by-product of barley)" [Landsberger & Gurney 1957-58, 337-38]. Landsberger was the first to quote Nies, *UDT* 1 as a reference to three generic words for legumes, spices and aromatics: Rev. 1) [X.X.X.X **(sìla) gú-há [gur]**, 2) [X](?).**0.0.8 sìla mun-gazi-há**, 3) [X] **ma-na šim-há**. The term **mun-gazi(-há)** in *UDT* 1 is undoubtedly a generic word for a certain group of plants/products. Landsberger's interpretation of **(gán) ki mun-gazi** in *TuT* 5 is much to be preferred to that of Oppenheim, though the expression **0.2.3.0-ta** that follows **(gán) ki mun-gazi** does not denote the barley as a "by-product".

Landsberger's identification of **gazi** (*kasû*) as "mustard" has, however, often been questioned [Snell 1982, 219 (cassia ?); Geller 1982, 194 (*Beta vulgaris*, or the common beet); Butz 1984, 316 (*Solanum nigrum/Solanum miniatum* ?)]. If either of the latter two identifications is to be

accepted, the semantic range of **mun-gazi** was more extensive than the connotations of English "spice"/"spice plants". First of all, salt (**mun**) and "bricks of salt" (**sig$_4$-mun** : *libitti ṭâbti*) [Potts 1984, 259; Butz 1984, 297]) as well as plants were also classed among the **mun-gazi** products.

II.2 The term **mun-gazi(-há)** occurs as a generic word side by side with **gú(-há)** ("legumes") and **šim(-há)** ("aromatics") in *UDT* 1. It should however be noticed that several Ur III texts use the term **mun-gazi** for a wide range of plants and products including legumes.

The following plants and products are classed as **mun-gazi**. The Akkadian equivalents *hallūru* and *kakkû* to **gú-gal(-gal)** and **gú-tur(-tur)** are translated as "chick-peas" and "lentil (or small bean)" in the *Chicago Assyrian Dictionary*. In view of doubts raised about these identifications at the 3rd meeting of the Sumerian Agriculture Group (June 29-30th, 1984), and since I cannot offer new evidence that might be helpful in identifying these two kinds of legumes, in this article I have provisionally adopted the literal, neutral translations "big pulse" and "small pulse" for **gú-gal(-gal)** and **gú-tur(-tur)** respectively.

1. Pinches, *Berens* 22 Obv.I.10-12, 19, Rev.IV.13 (Girsu):
   gú-gal (*hallūru* : "big pulses"), **še-lú** (*kisibirru* : coriander), **zi-zi-bí-a-núm** (*zibiânu* : "black cumin").

2. Pinches, *Amherst* 69 (Girsu):
   gú-gal(-gal), gú-tur (*kakkû* : "small pulse"), **Ú.TIR** (*kamunu* : cumin ?), **še-lú, gazi** (*kasû* : a native spice plant), **še.zi-bí-tum** (*zibitu* : an aromatic seed), **Ú.KUR** (=**Ú.KUR.RA(šim.bi.ri.da)**? [*ninû* ? : a medicinal plant]?), **numun zà-hi-li** ([**zà-hi-li** : *sahlû* : cress]: cress seed), **KU.MUL** (**ku-mul** = Sargonic **ga-mul** ? (= cumin?) [Snell 1982, 227]), **hu-rí-um** (*huri'u* : a spice), **sig$_4$-mun** (*libitti ṭâbti* : bricks of salt [Potts 1984, 259; Butz 1984, 297], **mun** (*ṭâbtu* : salt).

3. *MVN* I 74 (Umma):
   gú-gal, gú-tur, še-lú.

4. *MVN* I 75 (Umma):
   gú-gal, gú-tur, še-lú.

5. *MVN* I 104 (Umma):
   gazi-[kum](?), **Ú.KUR, še.zi-bí-tum, zà-hi-li, ga-ma-àm-tum** (*kamamtu* : a vegetable), **NIG.NAGAR, HI.sar** (**HI.sar = HI.IS.sar** : *hassu* : lettuce).

6. *TCL* V Pl. XXII-XXIII (AO 6037), Obv. II.20-III.11 (Umma):
   gú-gal, gú-tur, še-lú, Ú.TIR, numun sum-sikil ([**sum-sikil** : *šušikillu* : garlic (Gelb 1965, 57)]: garlic seed), **za-ha-tin** (*sahatinnu* : an onion [Gelb 1957, 238]).

In five of the six texts quoted above, legumes (**gú-gal(-gal), gú-tur(-tur)**) are listed first among the **mun-gazi** plants and products. Even onions and garlic are referred to in the last text as in the **mun-gazi** class of plants.

Many other Ur III tablets group the same kinds of plants and products that occur in the above texts into one class without the explicit mention of **mun-gazi** (e.g. *RTC* 307 Obv. III.20-IV.20; *ITT* II 892 Obv. III.17-IV.21), and legumes usually occur first in the group in these texts.

II.3 *CT* X 18-19 (BM 12922) dated in Amar-Suen 2 records the total yield from the domain land of various "temples" in Girsu (Table 1). A total of **24 gur$_7$ 2691 gur 47 sìla** (89,091 47/300 **gur** : 26,727,347 litres) of barley, emmer and wheat was harvested early in the 2nd year of Amar-Suen (1 **gur$_7$** = 3,600 **gur**, 1 **gur** = 300 **sìla**, 1 **sìla** = approx. 1 litre). Since **1 gur$_7$ 825 gur** (4,425 **gur** : 1,327,500 litres) of barley was allotted to "cultivators" (**engar**) and their subordinates as their provisions (**še-ŠUKU-ra engar**), the remaining **23 gur$_7$ 1866 gur 47 sìla** (84,666 47/300 **gur** : 25,399,847 litres) accrued to the administration in Amar-Suen 2. According to *CT* VII 8 (BM 12926) dated in the same year, in fact, this amount of **23 gur$_7$ 1866 gur 47 sìla** reached about 85% of the grand total income of Girsu in Amar-Suen 2.

The following yield of winter crops other than barley, emmer and wheat came from the Girsu domain land in Amar-Suen 2: **66 gur 275 sìla** (20,075 litres) of "big pulses" (**gú-gal(-gal)**), **6 gur 20 sìla** (1,820 litres) of coriander (**še-lú**), **295 sìla** (295 litres) of black cumin(?) (**zi-zi(-bí)-a-núm**), and **10 sìla** (10 litres) of cumin(?)(**Ú.TIR**). All of these plants are under the classification of **mun-gazi** in the texts quoted in Part II.2, though *CT* X 18-19 does not refer to the term in question. "Big pulses" came from the lands of Ningirsu, Ninmar.ki and other small "temples", and Dumuzi in Amar-Suen 2, and of the four plants the amount of "big pulses" was the largest. It might be a sound assumption that legumes and other plants such as coriander were cultivated in the **(gán) ki mun-gazi** plots of Ningirsu in Shulgi 47, three years earlier than Amar-Suen 2, and that legumes, especially "big pulses", predominated in these plots.

III. "Legume plots", "mun-gazi plots" and "vegetable plots"

III.1 Three terms occur in the "seed-and-fodder texts" and "yield texts" of Ur III Girsu to denote plots where plants other than barley (**še**), emmer (**zíz**) and wheat (**gig**) are cultivated: **(gán) ki gú, (gán) ki mun-gazi**, and **(gán) ki SAR.** The literal meanings of the first two terms are "plot of legumes" and "plot of **mun-gazi** plants" respectively. But the term **(gán) ki mun-gazi** is actually used in two ways in the texts. 1) The term denotes the plot where the **mun-gazi** plants other than legumes are cultivated. 2) It also refers to plots where legumes as well as other **mun-gazi** plants grow, or it is used as a generic term for both **mun-gazi** plots in the strict sense and legume plots. In *TuT* 5 the term **(gán) ki mun-gazi** seems to be used in the second connotation.

Both of these two usages are found in BM 21363, an unpublished "seed-and-fodder-text" dated to Shulgi 43. The text records the barley expenditures for cultivation of the following plots under the final supervision of a certain Ur-^{d}Ba-ú: **218 bùr** 6 **iku** (1,415 ha.) of Category A barley plots, **85 bùr 3 iku** (552 ha.) of Category B plots, **59(?) bùr** (382(?) ha.)

of Category C plots, and **1 bùr 9 iku** (10 ha.) of "**mun-gazi** plots" **(gán mun-gazi).**

The descriptions of BM 21363 on the "**mun-gazi** plots" are as follows: Obv. I.3) **1 (bùr) 3 (iku) gán mun-gazi**, 4) **mur-bi** (blank), ..., Rev. III.3) 6 **(iku) gán ki gú**, 4) **mur-bi 0.0.5.0**, ..., IV.10) **šu-nigín 1 (bùr) 9 (iku) gán mun-gazi**, 11) **mur-bi 0.3.4.0.** Both "**mun-gazi**-plots" (Obv. I.3) and "legume plots" (Rev. III.3) are again classified as "**mun-gazi** plots" in the summary description (Rev. IV.10).

The term **(gán) ki SAR** occurs side by side with **gán gú** (e.g. *CT* X 10-11: BM 24959 ["round tablet"]) and with **gán mun-gazi** (e.g. BM 15292 [=Table 3: "yield text"]). Since the word SAR can be used as a generic term for vegetables, **(gán) ki SAR** probably means the "vegetable plot". The "vegetable plot" **((gán) ki SAR)** which was under the management of the "cultivator" **(engar)** should be distinguished from the "garden/orchard" **((GIŠ.)SAR)**, managed by the "gardener" **(nu-GIŠ.SAR).** But my tentative interpretation is that in Ur III Girsu the main plants in the **(gán) ki SAR** plot were onions and garlic and that they also grew in the "garden/orchard". In fact, Barton *HLC* III 362 (Pl. 137), a record of smoked fish (**ku$_6$-izi** [Snell 1982, 226; cf. Oppenheim 1948, 8; Salonen 1970, 194]), onions and garlic **(sum-sikil, sum-gaz, sum.za-ha-tin)**, has a summary expression "account of fish and vegetables" **(níg-ŠID-ak ku$_6$ SAR)** [Gelb 1965, 60-61].

Girsu "yield texts" often mention legumes **(gú-gal(-gal), gú-tur(-tur))** and **mun-gazi** plants such as coriander (**še-lú**), cumin(?) (**Ú.TIR**) and black cumin(?) (**zi-zi(-bí)-a-núm**), side by side with the three main winter crops (barley, emmer and wheat). I have already discussed *CT* X 18-19 (Table 1) as an example. On the other hand, BM 17782 (unpublished) is the only Girsu "yield text" known to me that records a harvest of garlic (**sum-sikil**) as well as barley, emmer, legumes (**gú-gal-gal, gú-tur**) and coriander.

III.2 Two kinds of legumes **(gú-gal(-gal)** and **gú-tur(-tur))** were planted prevailingly in the plots called **(gán) ki gú** in Ur III Girsu. They are always listed before other **mun-gazi** plants in Girsu "yield texts".

The first occurrence of these legumes is in the texts of the Sargonic period (ca. 2350-2100 B.C.): e.g. *BIN* VIII 132 Obv. I.7-8 **(gú-gú-gal, gú-gú-tur)**; *RTC* 108 Obv.3-4 **(gú-gú-gal-gal, gú-gú-tur-tur).** On the other hand, pre-Sargonic Girsu texts dating to ca. 2370 B.C. mention a kind of legume called **gú-gú(-GU$_4$)** and coriander (**še-lú**) as being planted in the **ki-sum-ma** plots (literally "onion plots") (e.g. *VS* XIV 40 [Bauer 1972, 74-84]) [Deimel 1925, 1-33]. It is evident, however, that onions and garlic were by far dominant in the **ki-sum-ma** plots in pre-Sargonic Girsu. Although onions and garlic grew also in the "garden/orchard" (**SAR**) in the pre-Sargonic period (e.g. *DP* 384), no texts mention the cultivation of legumes or coriander in the "garden/orchard".

The plots of legumes and other **mun-gazi** plants **((gán) ki gú, (gán) ki mun-gazi)** seem to have been separated from the plots of onions and garlic **((gán) ki SAR)** in the Ur III period at the latest, probably as a result of the increasing popularity of legume cultivation. I do not know whether

pre-Sargonic **gú-gú(-GU$_4$)** denotes either of the two kinds of legume found i later periods.

III.3 *CT* X 18-19, the final record of harvest from the domain land of al the "temples" of Girsu in Amar-Suen 2, suggests that the yield of "bi pulses" (**gú-gal(-gal)**) was usually much larger than that of "small pulse in the "temple" land of Girsu. On the land where conditions were rath different from those of the "temple" land, however, plots of "small pulse may have been as extensive as those of "big pulses".

For example, BM 19739 (Maekawa 1981, Text 5), an "account of cereals o Susa" (**níg-ŠID-ak še-Šušin^{ki}**), only mentions "small pulses" (**gú-tur-tur** other than barley, emmer and wheat: Obv. I.1) [X] **gur$_7$ 400.4.3.6 2/3 sìl še gur-^{d}šul-gi**, 2) 3(?).**4.3.0 zíz gur**, 3) [X](?)+**1.4.0.0 gig gur**, 4 [10](?)+**8.4.0.0 gú-tur-tur gur**, 5) **gán-gu$_4$**, ... 10) **103.2+[2].0.[2](? gur**, 11) **1.1.0.0 zíz gur**, 12) **0.0.1.0 gig**, 13) **1.1.0.2 sìla gú-tur-tu gur**, 14) **gán apin-lá**, ..., III.1) **171 (bùr) gán 3.0.0.0 gur-ta**, 2) **(bùr) 15½ (iku) gán giš-gab-tab 2.0.3.0-ta**, 3) **še-numun mur-gu$_4$-b 521.0.3.2 ½ sìla gur**, 4) **6½ (iku) gán 2.0.3.0-ta**, 5) **gú-numun-bi 0.3.4. ½ sìla**, 6) **mur-gu$_4$-bi 0.1.3.7 ½ sìla**, 7) **gán-ur$_x$-a**, ..., Rev. VII.3' **2300+[1](?)+[X.X.X].1 sìla še gur**, 4') **5.0.3.0 zíz gur**, 5') **1.4.1.0 gi gur**, 6') **19.0.0.9 ½ sìla gú-tur-tur gur**, VIII.1) **[lá-NI-àm]**, ...

The text records that "legumes" (**gú**) were sown in the plots of **6½ ik** (2.3 ha.) (Obv. III.4-6). But the term **gú** must be an abbreviation of **gú-tur-tur** ("small pulses") because only "small pulses" occur together wit barley, emmer and wheat in the descriptions of "income" and "remainder".

According to Obv.III.1-3, barley was consumed as "seed-and-fodder" (**še-numun mur-gu$_4$**) at the rate of **3 gur** per **bùr** (139 litres per ha.) fo **171 bùr** (1,108 ha.) of barley plots, while **2 gur 30 sìla** (=2.1 **gur**) o barley was sown per **bùr** (97 litres per ha.) with the use of the **giš-gab-tab** implements for barley plots of **3 bùr 15½ iku** (25 ha.). I assume that th sowing rate of barley was also fixed to 2.1 **gur** per **bùr** in the plot classified as **gán 3.0.0.0 gur-ta**, and that 0.9 **gur** of barley was given to animals which plowed one **bùr** of land. In other words, the barley wa solely consumed as seed at the rate of 2.1 **gur** per **bùr** for the plots called **gán giš-gab-tab 2.0.3.0-ta.**

The term **giš-gab-tab** points to the implement with which a team of men sowed cereal seed. The **giš-gab-tab** implement was usually used without th aid of draught animals [Maekawa 1984, 80]. It might be a long pole with which a team of men stand parallel so as to drop cereal seeds into a numbe of furrows by hand simultaneously. In fact, *TuT* 17 and BM 19045 (Maekawa 1982, Text 15) demonstrate that a team of twelve men worked with one **giš-gab-tab** implement [Maekawa 1982, 87-89]. The Sumerian compound verb **gab — tab** means "to hold (something) to the breast" [Römer SKIZ, 254].

The two standard amounts of "seed-and-fodder" for barley plots of the "temple" in Girsu were 1.5 **gur** per **bùr** (Category A plots) and 1.8 **gur** per **bùr** (Category B plots) near the end of Shulgi's reign. One **gur** of barley was sown per **bùr** for Category A plots, while the rate of animal fodder was 0.5 **gur** per **bùr**. For Category B plots, the rate of barley seed and that

of animal fodder were respectively fixed at 1.2 **gur** and 0.6 **gur** per **bùr** [Maekawa 1984, 77-79]. On the other hand, the barley seed to be sown with the aid of the **giš-gab-tab** implement was usually 1.2 **gur** per **bùr** (Category C plots) but sometimes 1 **gur** per **bùr** (e.g. *CT* IX 32 [BM 21137] Obv.8-12, 15, Rev.6-7). It should also be noticed that men set up twelve furrows (**ab-sín**) at the basic seeding unit of one square **nindan** (approx. 6 metres) for the plot where 1.2 **gur** of barley was to be sown per **bùr.**

If my assumption that the sowing rate of barley for the land described in BM 19739 was fixed at 2.1 **gur** per **bùr**, i.e. approximately twice as large as that in the "temple" land, is to be accepted, conditions of the land in BM 19739 were very different from those of the common "temple" land of Girsu. I conclude that the land in question was situated far beyond the eastern border of Girsu, because the text mentions the rations of barley to the laborers (**UN-íl**) who were "stationed at (or dispatched to) Susa", and those who were "dispatched from Girsu" (Obv.IV.10 [=Rev.VI.1']) **UN-íl [libir](?) Šušin^{ki}** DU.[ ], Rev.VI.3') **še-ba UN-íl Gír-su^{ki}-ta gen-na).**

According to BM 19739, Obv.III.4-6, the amount of "small pulse" seed was **2 gur 30 sìla** (2.1 **gur**) per **bùr.** Since 97½ **sìla** of barley was given to the animals which plowed 6½ **iku** of "small pulse" plots, the rate of animal fodder was 270 **sìla** (0.9 **gur**) per **bùr.** The amount of "small pulse" seed and that of barley fodder per unit area are exactly the same as those of barley seed and fodder used for the common barley plots of BM 19739.

BM 19739 is the only available Ur III source of information on the amount of legume seed per unit area. But it is highly improbable that the same sowing rate (2.1 **gur** per **bùr**) was applied for the "temple" plots of legumes. My assumption is that one **gur** of legume seed or **mun-gazi** seed was sown per **bùr** in the "temple" land of Girsu near the end of the reign of Shulgi.

The standard amount of barley fodder given to animals which plowed the "temple" land was 0.5 **gur** per **bùr** both for barley plots and for plots of legumes and **mun-gazi** plants. The principle which BM 19739 suggests is that the same sowing rate as well as the same rate of animal fodder is applied both for barley plots and for "small pulse" plots. If this might also be true of the "temple" land, men usually sowed one **gur** of legumes or **mun-gazi** seed per **bùr** on "temple" land.

IV. Land classification according to BM 24956

IV.1 BM 24956, an unpublished British Museum tablet dated in Shulgi 43, is a record of domain plots under the designation of either "deficit" (**lá-NI**) or "excess" (**diri**). By the generous permission of the Trustees of the British Museum, BM 24956 is presented here as Table 2 prior to my future publication of the copied text. Since the "temples" referred to in BM 24956 are the same as those which occur in *TuT* 5 (Maekawa 1984, Table 1 : Shulgi 47) and *CT* X 18-19 (Table 1 : Amar-Suen 2), I safely conclude that the text calculates the total area of the "deficit" land and the "excess" land in Girsu in Shulgi 43.

The terms "deficit" and "excess", which are naturally in complementary distribution in each land description for each public institution, seem to denote the discrepancy between the land area that was calculated in the latest cultivation planning and the area of the land in the original survey. If the area of the land which men decide to cultivate anew exceeds that which the original test survey has already calculated, the extra plots expected to be under cultivation seem to be designated as "excess". In fact, the terms "excess" and "deficit" occur in Reisner *TuT* 17, a record of sowing of the land which had been left unseeded for some unknown reasons.

The final "seed-and-fodder text" written for calculation of all the expenditures for cultivation of the entire domain land of Girsu in Shulgi 43, which could naturally be similar to *TuT* 5 dated in Shulgi 47, has not as yet been found. Thus, we are obliged to reconstruct the general pattern of cultivation of the Girsu domain land in Shulgi 43, by relying on BM 24956.

IV.2 In Shulgi 43, barley plots were classed into five according to the different amounts of "seed-and-fodder" consumed per **bùr**: **1 gur 240 sìla** (=1.8 **gur**) of barley per **bùr**, **1 gur 180 sìla** (=1.6 **gur**) per **bùr**, **1 gur 150 sìla** (=1.5 **gur**) per **bùr**, **1 gur 60 sìla** (=1.2 **gur**) per **bùr**, and **1 gur 30 sìla** (=1.1 **gur**) per **bùr**. Barley plots of 1.8 **gur** per **bùr**, 1.5 **gur** and 1.2 **gur** are also found in *TuT* 5 of Shulgi 47, and they are respectively called plots of Categories B, A and C in my article in *BSA* 1 (1984).

The basic principles in the land classification in Shulgi 43 are not so different from those in Shulgi 47. Both in BM 24956 and *TuT* 5, Category A plots (plots of 1.5 **gur** per **bùr**) were the most extensive, and Category B plots (plots of 1.8 **gur** per **bùr**) come after them. It is only in the land of the "temple" of Ninmar.ki that Category B plots exceeded Category A plots in area in Shulgi 47, and BM 24956 seems to point to the same peculiar condition of the land of Ninmar.ki.

According to *TuT* 5, almost all of the Category C plots (plots of 1.2 **gur** per **bùr**) were situated in the land of "oxen of the boots(?)" (**gu$_4$-suhúb**) and the **E.SU.DAR** field (**a-šà E.SU.DAR**), both of which were under the direct management of the governor of Girsu. In Shulgi 43 also, those who were independent from the "temples" cultivated 1.2 **gur** plots and 1.1 **gur** plots.

Since plots of 1.6 **gur** per **bùr** and those of 1.1 **gur** are no longer attested in *TuT* 5, written in Shulgi 47, these categories seem to have been re-classed into Categories A and C respectively by that year.

IV.3 BM 24956 (Table 2) mentions "plots of legumes" (**(gán) ki gú 0.2.3.0-ta**) under the classification of either "deficit" or "excess" for the lands of Ningirsu, Ninmar.ki, Ningishzida, Igalim, Nanshe, Gatumdu and Dumuzi, while the text alludes to "plots of vegetables" (**(gán) ki SAR 0.2.3.0-ta**) in the designation of "deficit" for the "temple" of Shulgi. But the term **(gán) ki mun-gazi** does not occur in BM 24956. The expression **0.2.3.0-ta** in these passages undoubtedly means that 150 **sìla** (=0.5 **gur**) of barley was

to be expended as fodder of plow animals for sowing one **bùr** of the plots in question.

It is still unknown whether **mun-gazi** plants such as coriander were also to be cultivated in these "plots of legumes" in BM 24956. In the summary description of BM 21363, the unpublished "seed-and-fodder text" which records the cultivation of the domain land under a certain Ur-^{d}Ba-ú in Shulgi 43, **1 bùr 13 iku** of **mun-gazi** plots (**gán mun-gazi**) and **6 iku** of plots of legumes (**(gán) ki gú**) are again under the classification of **gán mun-gazi**. Ur-^{d}Ba-ú in BM 21363 is identified with the man of the same name who occurs in BM 24956 together with a certain Ur-^{d}Ig-alim as being responsible for the management of the land of Ningirsu. Ur-^{d}Ba-ú managed the land of Ningirsu including **11 iku** (4 ha.) of "plots of legumes" under the classification of "deficit" in Shulgi 43. "Plots of legumes" and "plots of vegetables" classified either as "deficit" or as "excess", reached around 3 **bùr 14½ iku** in all in the Girsu domain land in Shulgi 43 ("deficit": **3 bùr 1½+[X](?) iku**; "excess": **13 iku**).

More important is the fact that BM 24956 refers to "plots of legumes" or "plots of vegetables" under the designation of either "deficit" or "excess" for almost all the "temples" of Girsu. Almost all the "temples" may actually have cultivated "plots of legumes" or "plots of vegetables" of one or two **bùr** in area in Shulgi 43. If this assumption is accepted, the management of "plots of legumes" and "plots of vegetables" in Shulgi 43 is quite different from what *TuT* 5 describes for the 47th year of Shulgi. *TuT* 5 only mentions **11 bùr** of **mun-gazi** plots (**(gán) ki mun-gazi**) under the control of the "temple" of Ningirsu as the land where crops other than barley, emmer and wheat grew in Shulgi 47. The corollary is that the yearly variations in the cultivation of legumes and other **mun-gazi** plants in the Girsu "temple" land were so large near the end of Shulgi's reign.

Ur-^{d}Ba-ú managed the cultivation of **1 bùr 13 iku** of **mun-gazi** plots and **6 iku** of legume plots for the "temple" of Ningirsu in Shulgi 43 (BM 21363), and approximately the same area of land was probably reserved for these plants under Ur-^{d}Ig-alim, the other administrator of Ningirsu. But the grand total area was probably much smaller than **11 bùr**, the figure which *TuT* 5 mentions as the area of **mun-gazi** plots of Ningirsu in Shulgi 47.

V. Small-scale cultivation of legumes and mun-gazi plants

V.1 According to BM 20055 (Maekawa 1982, Text 1) and BM 28407 (unpublished), the grand total of the cultivated domain land of Girsu reached **4,034 bùr 17¾ iku** (26,147 ha.) in Shulgi 41. It is now possible for me to discuss the general cultivation pattern of the Girsu domain land in Shulgi 41, because many "seed-and-fodder texts" for the land cultivation of individual "temples" have now become available to me.

It is only the "seed-and-fodder texts" of the "temples" of Ningirsu and Igalim that mention the cultivation of "legume plots" in Shulgi 41. In this year both Ur-^{d}Ba-ú and ^{d}Utu-mu controlled the "temple" land of Ningirsu. BM 19093 (Maekawa 1981, Text 6) and BM 25035 (unpublished) are

the two fragments of the "seed-and-fodder text" for the land managed by Ur-^{d}Ba-ú. According to them, **1 bùr 9 iku** (10 ha.) of land was reserved for cultivation of legumes:

BM 25035 Obv. I.8) **14 (iku) gán gú šabra-é**, 9) **mur-bi 0.2.0.0 1á 0.0.0.5 sìla**, 10) **a-šà gír-nun**, ..., BM 19093 Obv. I.3') **13 (iku) gán gú šabra-é**, 4') **mur-bi 0.1.5.0**, 5') **a-šà za-ha-tin**, ..., Rev. IV.6) **šu-nigín 0.3.4.5 sìla mur-gu$_4$ gú 1 (bùr) 9 (iku) gán-kam.**

^{d}Utu-mu also managed **1 bùr 13 iku** of legume plots for the "temple" of Ningirsu in Shulgi 41 [BM 18356 (Maekawa 1981, Text 10); duplicate: BM 12401 (Maekawa 1981, Text 7) + BM 21145 (unpublished)]:

BM 18356 Obv. I.5) **1 (bùr) gán gú šabra-é**, 6) **a-šà gír-nun**, ..., II.19) **13 (iku) gán gú šabra-[é]**, 20) **a-šà za-ha-tin**, ..., Rev. IV.7) **⟨šu-nigín⟩ 0.4.1.8 1/3 sìla mur-gu$_4$ gú [gán] 1 (bùr) 13 (iku) gán-u$_x$-a-kam.**

Thus the four legume plots of Ningirsu, which were in the fields named **a-šà gír-nun** and **a-šà za-ha-tin**, were specially cultivated by the major domo (**šabra-é**). It should also be noted that **a-šà za-ha-tin** is translated as "field of **za-ha-tin** onions".

It does not follow, however, that legumes and **mun-gazi** plants were not cultivated in other fields for the "temple" of Ningirsu in Shulgi 41. In my opinion, men actually sowed a very small amount of legume seeds and **mun-gazi** seeds in several other "barley" plots of Ningirsu in Shulgi 41. In other words, the "seed-and-fodder texts" only mention the large scale cultivation of legumes and **mun-gazi** plants.

V.2. BM 24973 (unpublished) records that twenty "cultivators" (**engar**) brought harvest early in Shulgi 40 under the supervision of ^{d}Utu-mu, major-domo (**šabra**) of Ningirsu. The actual area of the land is not mentioned in this text. BM 24973 classifies the harvest into two kinds: yield of barley, emmer and wheat (**še giš è-a**) and "(a mixture of) barley (and emmer?) and **mun-gazi** yield" (**še mun-gazi**). The total yield of cereals reached **3,991 gur 289 sìla** (1,197,589 litres), while **38 gur** (11,400 litres) of "barley and **mun-gazi** yield" was brought to the administration.

Thirteen of a total of twenty "cultivators" brought "barley and **mun-gazi** yield" as well as cereals: eight "cultivators" **3 gur** of "barley and **mun-gazi** yield" each, three "cultivators" **2 gur** each, and two **4 gur**. The reason why all the amounts of "barley and **mun-gazi** yield" are expressed in the integral **gur**-figures is still unknown to us.

According to *MVN* VI 288 (L. 7297), the same type of record of yield from the "temple" land of Namhani in Shu-Suen 2, as many as thirty-three of a total of thirty-eight "cultivators" brought "barley and **mun-gazi** yield" (**še mun-gazi**) as well as yield of cereals. In each case the amount of "barley and **mun-gazi** yield" is very small. The occurrence of 1 **gur** is most usual, while the maximum amount is **1 gur 60 sìla** (1.1 **gur**).

V.3. The word **še** in the term **še.mun-gazi** in BM 24973 and *MVN* VI 288 should not be interpreted as a determinative. The reason is simply that **mun-gazi** plants are never under the classification of "cereals" (**še**).

Reisner *TuT* 1 may be offered as a support for the interpretation of **še.mun-gazi** as **še mun-gazi** ("(a mixture of) barley and **mun-gazi** yield"). The following expressions for the yield of legumes are found in *TuT* 1, the text of yield from the land of Namhani in an unknown year (Tables 4 and 5): **gú-gal** (Obv.I.2: **19 gur 180 sìla**), **gú** (I.32: **1 gur**), **še.gú** (Rev.VI.11: **270 sìla**), **gú-gal** (VI.12: **10 gur 60 sìla**). The term **še-gú** in Rev.VI.11 is to be read as **še gú** ("cereals and legumes"). If we were to adopt the interpretation of **še** here as a determinative, we would be unable to explain why **gú-gal** occurs without **še** in the next line.

It should also be noticed that the expression **še gú** comes between the description of yield of cereals (Rev.VI.10) and that of "big pulses" (VI.12). My assumption is that the "cultivator" harvested a mixture of cereals and legumes (more exactly "big pulses") from some furrows where he had seeded cereals and legumes in admixture.

Thompson's interpretation of **še.gú**, **še.gú-tur** and **še.gú-gal** as denoting legumes only is unsubstantiated [Thompson 1949, 95, 105].

V.4. The term **še mun-gazi** ("barley and **mun-gazi** yield") in BM 24973 and *MVN* VI 288 probably connotes the small-scale cultivation of **mun-gazi** plants which none of the "seed-and-fodder texts" mentions explicitly. "Cultivators" probably seeded a mixture of barley seeds and **mun-gazi** seeds in a small number of furrows in their "plots of barley". In other words, the lands of "barley and **mun-gazi** plants" were under the overall classification of "barley plots" in the "seed-and-fodder texts".

This might also be true of the "seed-and-fodder texts" dated in Shulgi 41 and 47. The "seed-and-fodder texts" of Ningirsu and Igalim mention the large-scale cultivation of legumes in Shulgi 41, but the personnel of these "temples" probably cultivated legumes and **mun-gazi** plants on a very small scale in their "barley plots" also. It is a natural assumption that a small amount of legumes and **mun-gazi** plants also came from the "barley plots" of other "temples" in Shulgi 41-42.

Althoguh *TuT* 5, dated in Shulgi 47, only refers to **11 bùr** of "**mun-gazi** plots" of Ningirsu, the small-scale cultivation of legumes and **mun-gazi** plants might also be observed in the "barley plots". But this type of legume/**mun-gazi** cultivation on a small scale does not necessitate any serious correction of the conclusion I obtained from *TuT* 5 as to the relative proportions of the land area of different crops.

BM 15292 and BM 23585, which are the fragments of one large "yield text", are another source of information on the small-scale cultivation of **mun-gazi** plants. Although the lines for the year formula are badly defaced, the original tablet was certainly written in the 30's or 40's of the reign of Shulgi when Ur-^{d}Lama was governor of Girsu.

The summary descriptions of the original tablet are found in BM 15292:

Rev.II'.1') **[ŠU-nigin]⌜720⌝+120+[X (bùr) X (iku) gán]**
2') **ŠU-nigin 186 (bùr) 4 (iku) [gán]-na[m]**

3') **ŠU-nigin 13 (bùr) 16¾ (iku) gá[n] UDU**
4') **ŠU-nigin 11¼ (iku) gán zíz**
5') **ŠU-nigin 1 (bùr) 13½ (iku) gán mun-gazi**
6') **ŠU-nigin 17¾ (iku) gán ki SAR**
7') **ŠU-nigin 1 (bùr) ¼ (iku) gán ki SAR Šabra**
8') **ŠU-nigin 94 (bùr) 8½ (iku) gán SIR**
9') **ŠU-nigin 2 (bùr) ¾ (iku) gán SIR UDU**
10') **ŠU-nigin ŠE-bi 2 gur$_7$ 2207.1.0.7 sìla gur-lugal**
11') **ŠU-nigin zíz-bi 9.1.2.6 2/3 sìla gur**
.....

The total area of **mun-gazi** plots (**gán mun-gazi**) is 1 **bùr 13½ iku** (11 ha.). There also existed "plots of vegetables" (**(gán) ki SAR, (gán) ki SAR Šabra**) of 2 **bùr** (13 ha.) in all.

All the descriptions that record that "cultivators" managed **mun-gazi** parcels as well as plots of cereals are excerpted from BM 15292 and BM 23585 (Table 3). Table 3 demonstrates that all of the **mun-gazi** parcels are very small in area (¾ **iku**, 1 **iku**, and 1½ **iku**). On the other hand, the average area of the domain unit which each "cultivator" managed was 6-8 **bùr** (39-52 ha.). Since the grand total of **mun-gazi** parcels is 1 **bùr 13½ iku**, in its original perfect condition the tablet would have recorded approximately thirty **mun-gazi** parcels. My assumption is that about half of the "cultivators" managed **mun-gazi** parcels as well as plots of cereals.

A different management principle seems to have been applied to "plots of vegetables". The latter plots occur only once in BM 15292; BM 15292 Obv.I'.7') [X]+¼ **(iku) gán ŠE ki SAR**, 8') [X **(iku)] gán ki SAR.** This suggests that "plots of vegetables" were not divided into so many small parcels.

VI. Large-scale cultivation of legumes

Reisner *TuT* 1, the record of yield from the "temple" land of Namhani in an unknown year near the end of Shulgi's reign, points to the large-scale cultivation of legumes by a limited number of "cultivators". This is quite different from the cultivation of small **mun-gazi** parcels attested in BM 15292 and BM 23585. *TuT* 1, which I have already tabulated in my 1974 article [Maekawa 1974, Tables 6-7], is reproduced here as Tables 4 (Obv. I.1-V.1) and 5 (Obv. V.2-Rev. IX.1). The text records that three out of twenty-six "cultivators" brought yields of legumes to the administration:

1) A "cultivator" named Ba-zi brought **19 gur 180 sìla** of "big pulses" (**gú-gal**) from his "legume plot" (**gán gú**) of **1 bùr 6 iku** (Obv. I.1-9).
2) Ur-gá harvested 1 **gur** of "legumes" (**gú**). But the text does not mention the area of land from which the "legumes" came (Obv. I.31-II.7).

3) ^{d}Inanna-ka harvested **10 gur 60 sìla** of "big pulses" (**gú-gal**) from the plot of **1 bùr 2 iku.** Although he also brought **270 sìla** of "barley and legumes" (**ŠE gú**), the area reserved for "barley and legumes" is not mentioned explicitly.

The descriptions 1 and 3 are the sole sources that inform us of the productivity of legumes per unit area (description 1: **14 gur 210 sìla** per **bùr** [681 litres per ha.]; description 3: **9 gur 54 sìla** per **bùr** [425 litres per ha.]). These two plots of "big pulses" (**gú-gal**) under the management of Ba-zi and ^{d}Inanna-ka were situated in the field named **a-ŠÀ SIR-gán ^{d}Nin-dar-a**, and they are relatively large.

On the other hand, the text does not refer to the actual figures of the area of the lands from which Ur-gá and ^{d}Inanna-ka brought "legumes" (**gú**) and "barley and legumes" (**ŠE gú**) respectively. The reasons are probably that Ur-gá's land for legumes was very small in area, and that a mixture of barley seeds and legume seeds was sown in some furrows in the land of ^{d}Inanna-ka.

VII. Conclusions

Two different cultivation patterns for legumes and other **mun-gazi** plants can be observed in the Girsu texts. First, only a limited number of the "cultivators" working for each "temple" managed both plots of cereals and plots with other kinds of plant. The consequence is that in each of these cases the plots reserved for plants other than cereals were remarkably large in area. This type of large-scale cultivation seems to have undergone considerable yearly variations. *TuT* 1 (Tables 4 and 5), the text of the yield from the land of Namhani in an unknown year, illustrates this type of large-scale cultivation of "big pulses" (**gú-gal**); but legume cultivation is mentioned neither in the "seed-and-fodder text" written in Shulgi 41 for Namhani (BM 25013, BM 25017 [both unpublished]), nor in *TuT* 5 of Shulgi 47.

The other cultivation pattern is represented by a considerable number of "cultivators" who sowed legumes and **mun-gazi** seeds on a very small scale within their domain plots. This kind of small-scale cultivation is not mentioned by "seed-and-fodder texts" but by "yield texts" such as BM 24973 discussed in section V.2 above, BM 25292 and BM 23585 (Table 3), and *TuT* 1 (Tables 4-5).

A general tendency was probably that legumes ("big" and "small pulses") were often planted in the large plots, while "cultivators" often sowed other **mun-gazi** plants such as coriander on a very small scale.

Almost all the texts of land management which I have quoted in this article are dated near the end of the reign of Shulgi. An interesting question is whether or not changes took place in the cultivation of legumes and **mun-gazi** plants after his reign, but that is beyond the scope of this article.

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TABLES 1 TO 5

Table 1 *CT* X 18-19 [BM 12922]

Table 2 BM 24596

Table 3 BM 15292 + BM 23585

Table 4 *TuT* 1 Obv. I 1 - V 1

Table 5 *TuT* 1 Obv. V 2 - Rev. IX 1

Remarks to Table 1: p. 117
Remarks to Tables 3-5: p. 118

Table 1 (CT X 18–19 [BM12922]; Amar-Suen 2)

column	"temple"		administrator	še gán-gu$_4$ (yield from the domain land) A. še (barley, emmer, wheat)	B. gú-gal(-gal)	C. še-lú (coriander)	D. zi-zi(-bí)-a-núm (black cumin?)	E. Ú.TIR (cumin?)	F. še é-kin-gá (?)	G. še-ŠUKU-ra engar (provisions to "cultivators")
Obv. I 1–12	é-^{d}Nin-gír-su	é-^{d}Nin-gír-su	————	13,433gur 131sìla	22gur 120sìla	5gur 80sìla	130sìla	0	0	680gur
I 13–19		é-šabra	Ur-^{d}Nanše	4,249 160	0	0	0	0	0	286
II 1–9	é-^{d}Nanše, é-šabra		DU.DU	11,439 47	0	0	0	0	0	698
II 10–III 5	é-^{d}Nin-mar.ki, é-ba-gár é-^{d}Gá-tùm-du$_{10}$, é-^{d}Inanna		sanga-^{d}Nin-mar.ki	24,447 141	38 180	240	165	10sìla	0	800
III 6–15	é-^{d}Nin-giš-zi-da		Ur-é-ninnu (?)	4,659 80	0	0	0	0	0	403
III 16–Rev. IV 2	é-^{d}Šul-gi		Lugal-síg-gíd	3,736+[X] 120	0	0	0	0	0	180+[11]
IV 3–9			Ur-šu-ga-lam-ma	4,205+[X] 120	0	0	0	0	0	249
IV 10–14	é-^{d}Nin-dar-a		sanga-^{d}Nin-dar-a	2,554 190	0	0	0	0	0	184
IV 15–V 3	é-^{d}Dumu-zi		sanga-^{d}Dumu-zi	7,697 183	5 275	0	0	0	0	364
V 4–9	é-Nam-ha-ni		————	4,035 120	0	0	0	0	0	370
V 10–15	é-URUxKÁR^{ki}		sanga-URUxKÁR^{ki}	3,146 140	0	0	0	0	0	200
V 16–18	————			0	0	0	0	0	231gur 115sìla	0
V 19–VI 10	total			84,666gur 47sìla (A+F) (25,399,847 *l.*)	66gur 275sìla (20,075 *l.*)	6gur 20sìla (1,820 *l.*)	295sìla (295 *l.*)	10sìla (10 *l.*)	(231gur 115sìla)	4,425gur (1,327,500 *l.*)

Table 2 (BM 24596; Shulgi 43)

column	"temple", field	lá-Nl, diri barley plot legume plot / category of plots / administrator	lá-Nl ("deficit") gán(-še) (barley plot) B (1.8gur/bùr)	(1.6gur/bùr)	A (1.5gur/bùr)	C (1.2gur/bùr)	(1.1gur/bùr)	(gán) ki gú (legume plot) H (0.5gur/bùr)	barley consumption	diri ("excess") gán(-še) (barley plot) A (1.5gur/bùr)	(1.1gur/bùr)	(gán) ki gú (legume plot) H (0.5gur/bùr)	barley consumption
Obv. I 1–5	é-^{d}Nin-gír-su	Ur-^{d}Ig-alim	4iku	0bùr	3bùr 16iku	0bùr	0bùr	$4^{1}/_{2}$ iku	6gur $107^{1}/_{2}$sìla	0bùr	0bùr	0bùr	0gur
I 6–10		Ur-^{d}Ba-ú (sanga)	0bùr	0	4 2	0	0	11	6 $141^{2}/_{3}$	0	0	0	0
I 11–19	é-^{d}Nin-mar.ki	Ur-^{d}Lama (dumu Nam-mah)	10 9	2	11 $7^{1}/_{4}$	4	0	0bùr	44 $61^{1}/_{4}$	0	0	4iku	$33^{1}/_{3}$ sìla
I 20–II 6		Ad-da-mu	[X X]	[0]	[X] $8^{3}/_{4}$	[X X]?	[0]	0	49 $91^{1}/_{4}$	0	0	$2^{1}/_{4}$	$18^{3}/_{4}$
II 7–11	é-Nam-ha-ni	Ma-an-sùn	$13^{1}/_{4}$	0	8 $10^{1}/_{4}$	0	0	4	14 $87^{1}/_{12}$	0	0	0	0
II 12–15		A-kal-la	0	0	0	0	0	0	0	0	0	1	$8^{1}/_{3}$
II 16–18	é-^{d}Šul-gi	Lú-NINA^{ki}	0	0	0	0	0	0	0	5bùr $3^{1}/_{2}$ iku	0	0	7 $237^{1}/_{2}$
II 19–24		Ur-šu-ga-lam-ma	0	0	0	0	0	$7^{3}/_{4}$*	$64^{7}/_{12}$	3 $11^{3}/_{4}$	0	0	5 $143^{3}/_{4}$
II 25–III 2′	é-^{d}Nin-giš-zi-da	Du$_{11}$-ga-zi-da	[X X]?	[X X]?	9 $5^{3}/_{4}$	[X X]?	[0]?	[0]?	[15 $9^{7}/_{12}$]?	0	0	0	0
III 3′–9′		Ur-^{d}Ig-alim	6	3	3 $12^{1}/_{2}$	0	0	$2^{1}/_{2}$	21 $63^{1}/_{3}$	0	0	0	0
III 10′–14′	é-^{d}Ig-alim	Ur-^{d}Lama	3 $12^{1}/_{2}$	0	8 16	0	0	$2^{1}/_{2}$	20 $15^{5}/_{6}$	0	0	0	0
III 15′-20′		Ad-da	$15^{1}/_{2}$	0	5 9	0	0	0	9 240	0	0	0	0
III 21′–24′	é-Lugal-URUxKÁR^{ki}	Ní̆g-ú-rum	1	0	3 $1^{1}/_{4}$	0	0	0	6 $121^{1}/_{4}$	0	0	0	0
III 25′-Rev. IV 4		Nam-mah	4 5	0	6 $7^{1}/_{4}$	0	0	0	17 $91^{1}/_{4}$	0	0	0	0
IV 5–8	é-^{d}Nanše	Ní̆g-ú-rum	0	0	6 $12^{3}/_{4}$	0	0	$^{1}/_{2}$	10 23	0	0	0	0
IV 9–14		Ur-é-ninnu	0	0	10 $13^{1}/_{4}$	0	0	0	16 $31^{1}/_{4}$	0	0	$5^{3}/_{4}$	48
IV 15–18	é-^{d}Gá-tùm-du$_{10}$	Ur-^{d}Ba-ú (dumu UN-íl)	0	0	6 13	0	0	11	10 $116^{2}/_{3}$	0	0	0	0
IV 19–23		Ur-ša$_{6}$-ga-mu	0	0	2	0	0	$10^{1}/_{4}$	3 $85^{1}/_{2}$	0	0	0	0
IV 24–27	é-^{d}[Nin-dar-a]	Lugal-uru-[da]	0	0	13	0	0	0	1 25	0	0	0	0
V 1–7	é-^{d}Dumu-zi	Ur-ša$_{6}$-ga	0	0	4 10	0	0	$1^{1}/_{2}$	6 $262^{1}/_{2}$	0	0	0	0
V 8–3		Ní̆g-^{d}Ba-ú, Lú-ib (dumu ÌBA.ME) Ur-^{d}Ba-ú (dumu LAM.LAM-ma)	0	0	0	1 $16^{1}/_{2}$	0	0	2 90	0	0	0	0
V.14–16	a-šà GíRgunû.	Ur-Sag-ùb^{ki}	0	0	0	1 $^{3}/_{4}$	0	0	1 75	0	0	0	0
V 17–19	GíRgunû é-babbár	^{d}Utu-mu	0	0	0	15	0	0	1	0	0	0	0
V 20–23	a-šà Lú-ša$_{6}$-ga	Ur-ša$_{6}$-ga (dumu Lugal-igi)	0	0	0	0	5bùr 12iku	0	6 70	0	0	0	0
V 24–26	a-šà sipa-e-ne	Šeš-kal-la	0	0	0	0	6 $4^{1}/_{2}$	0	6 $262^{1}/_{2}$	0	0	0	0
V 27–VI 5		Ur-^{d}Ig-alim (dumu UR.UR)	0	0	0	0	0	0	0	0	10bùr $3^{3}/_{4}$ iku	0	11 $68^{5}/_{6}$
VI 6–8	total		(27bùr $5^{1}/_{4}$iku +[X])	(5bùr sìla +[X])	(96bùr 14iku +[X])	(7bùr $14^{1}/_{2}$ iku +[X](?))	(11bùr $16^{1}/_{2}$ iku)	(3bùr $1^{1}/_{2}$ iku)	(276gur 36sìla)	(8bùr $15^{1}/_{4}$iku)	(10bùr $3^{3}/_{4}$ iku)	(13iku)	24gur $258^{1}/_{2}$ sìla

*(gán) ki SAR

Table 3 (BM 15292 + BM 23585)

text, column	engar ("cultivator")	barley plot						F. yield per bùr $\left(\frac{D}{A+B+C}\right)$	G. gán-zíz (emmer plot)	H. gán mun-gazi (plot of mun-gazi plants)
		A. gán(-še) (barley plot)	B. gán-SIR (?)	C. gán.UDU (barley plot for sheep grazing ?)	D. yield	E. yield per bùr $\left(\frac{D}{A}\right)$				
BM 15292 Obv. II 8'-13'	Lú-^{d}Giš-bar-è	4bùr 14 iku	2bùr 3 3/4iku	0bùr	246gur 227 1/3sìla	51gur 194sìla		35gur 96sìla	0bùr	1 1/2iku
BM 15292 Obv. III 9'-14'	Lú-nimgir	3 12 3/4	15 3/4	0	207 280	56 22		45 110	0	3/4
BM 23585 Obv. I' 2'-7'	[ ]	5 10 3/4	8 1/4	7 1/2iku	95 105	17 11		14 220	0	3/4
BM 23585 Obv. II' 4'-10'	[Še]š-kal-la	5 8 3/4	16 1/4	0	101 255	18 170		15 283	2iku	3/4
BM 23585 Obv. III' 6'-10'	[ ]	5 15 1/2	1 9	0	145 277	24 269		19 247	0	1
BM 23585 Rev. III 3'-8'	Lú-^{d}Nin-gír-su	3 7	1 2 1/4	0	71 83 1/3	21 10		15 237	0	1

Table 4 (TuT 1 Obv. 11 – V 1; ugula Ma-an-sùn)

column	a-šà (field)	engar ("cultivator")	I. area		II. mu-TÚM (yield actually brought to the administration)			III. lá-Nì ("deficit")		IV. (še-ŠUKU-ra engar) (provisions to "cultivators")			V. yield per bùr		
			A. gán(-še) (barley plot)	B. gán-gú ("legume" plot)	C. še (barley)	D. zíz (emmer)	E. gú (-gal) (legumes)	F. še (barley)	G. zíz (emmer)	H₁. engar	H₂. dumu-da-ba	H₃. dumu-gu₄-gur	I. $\frac{C+D+H}{A}$, $\frac{E}{B}$		
Obv. I 1–9	a-šà SIR-gán ^{d}Nin-dar-a	Ba-zi	8 bùr 6¼ iku	1bùr 6iku	212gur 180sìla	0bùr	19gur 180sìla (gú-gal)	0	0bùr	7gur	2gur	1gur	26gur 200sìla		(še)
													14 210		(gú-gal)
I 10–20	a-šà GIR$_4$-u^{ki}	Lum-ma	6 11	0	135 180	240sìla	0	30gur 140sìla	120sìla	4	2	1	21 207		(še+zíz)
I 21–30	a-šà SIR-gán-gu-la	Pú-ta-pà-da	7 11	0	122	0	0	4 190	0	4	2	1	16 285		
I 31–II 7	a-šá é-bil-le-gu-la ù gab a-šà ì-zi-na	Ur-gá	6 10¼	0	189 240	0	1 (gú)	22 206½	0	7	2	1	30 170		(še+gú)
II 8–14	a-šà ^{d}Nanše-gar-ra	Lugal-hé-gál	12 4	0	191 60	0	0	0	0	5	2	1	16 89		
II 15–21		Šu-eš$_8$-tár	8 8	0	149 120	0	0	0	0	5	2	1	18 192		
II 22–29	a-šà giš-tir-gab-gíd-da	Kal-la	9 ¼	0	457	0	0	0	0	12	2	1	52 109		
III 1–9	a-šà ì-zi-na	^{d}Nanše-kam	10 1	0	290	0	0	40	0	8	2	1	29 280		
III 10–19	a-šà ba-gár	Ur-^{d}En-ki	8 12	0	272 250	0	0	13 103⅓	0	8	2	1	32 225		
III 20–25	a-šà mah	Lú-URUxKÁR^{ki}	7 16	0	179 165	0	0	0	0	6	2	1	23 270		
III 26–IV 2		Ur-^{d}Ba-ú	6 11¾	0	141 260	0	0	0	0	4	2	1	23 113		
IV 3–5	a-šà du$_6$-èš	Ur-^{d}Suen	? (gán-nam)	0	45	0	0	0	0	3	1	1	?		
IV 6–12	a-šà a-geštin-na		? (gán-<nam>)	0	65 245	0	0	0	0				?		
IV 13–22	a-šà a-geštin-na	Ì-lí	10 8¾	0	110 245	0	0	65 235	0	3	1	1	11 13		
total			102 10¼ + X bùr Xiku	1bùr 6iku	2,563gur 145sìla	240sìla	20gur 180sìla	137gur 14⅚ sìla	120sìla	113gur					

Table 5 (TuT 1 Obv. V 2 – Rev. IX 1: ugula A-kal-la)

column	a-šà (field)	engar ("cultivator")	I. area A. gán(-še) (barley plot)	B. (gán) ki gú ("legume" plot)	II. mu-TÚM (yield actually brought to the administration) C. še (barley)	D. še gú (barley and legumes)	E. gú-gal	III. lá-NI ("deficit") F. še (barley)	IV. (še-ŠUKU-ra engar) (provisions to "cultivators") G1. engar	G2. dumu-da-ba	G3. dumu-gu4-gur	V. yield per bùr H. $\frac{C+D+G}{A}\cdot\frac{E}{B}$
Obv. V 2–7	a-šà ^{d}Nanše-gar-ra	^{d}Inanna-ka	10 bùr 9½ iku	0 bùr	163 gur 240 sìla	0 gur	0 gur	0 gur	5 gur	2 gur	1 gur	16 gur 96 sìla
V 8–15		Lugal-dumu-šè	9 15¼	0	162 120	0	0	0	5	2	1	17 91
Rev. VI 1–9	a-šà SIR-gán-gu-la	Ka$_5$-a	8 1½	0	123 180	0	0	6 gur 160 sìla	4	2	1	16 47
VI 10–20	a-šà SIR-gán ^{d}Nin-dar-a	^{d}Inanna-ka	7 6¼	1 bùr 2 iku	204 100	270 sìla	10 gur 60 sìla	0	7	2	1	29 88 (še+gú)
												8 54 (gú-gal)
VI 21–28		Ur-^{d}Ba-ú	13 12	0	430 (nu-bal)	0	0	20 100	12	2	1	32 168
VI 29–34	a-šà é-bil-le-tur	Nig-ga-ra-ni	10 3¼	0	384 (nu-bal)	0	0	0	12	2	1	39 58
VI 35–VII 7		Ur-Šaš$_4$-ga	10 15¼	0	330 (nu-bal)	0	0	0	10	2	1	31 186
VII 8–16	a-šà mah	Ur-KWU 715	8 17½	0	134 40	0	0	22 76⅔	5	2	1	15 252
VII 17–24	a-šà gíš-tir-gab-gíd-da	^{d}Nin-gír-su-ka	8 11¼	0	390 90	0	0	0	12	2	1	46 252
VII 25–33	a-šà GIR$_4$-u	Ur-zikum-ma	9 6¾	0	82	0	0	9	3	1	1	9 84
VII 34–VIII 8	a-šà a-eštim-na	Ur-bára-si-ga	11 10¼	0	241 240	0	0	76 296⅔	4	2	1	21 151
VIII 9–17	a-šà mah	Ka$_5$-a	9 ¼	0	134 185	0	0	6 60⅔	4	2	1	15 213
VIII 18–27	a-šà GIR$_4$-u	Ur-^{d}Šul-pa-è	6 5¾	0	99 120	0	0	4 147½	3	1	1	16 156
total			124 bùr 7¼ iku	1 bùr 2 iku	2,880 gur 115 sìla	270 sìla	10 gur 60 sìla	136 gur 182½ sìla	123 gur			

Remarks to Table 1 (CT X 18-19 [BM 12922])

Item A: The figures presented as Item A seem to point to the yield of the three main winter crops (barley, emmer and wheat), which came from the domain land (**gán-gu$_4$**) of various "temples" in Girsu early in Amar-Suen 2. The grand total (**84,666 gur 47 sìla [23 gur$_7$ 47 sìla]** : 25,399,847 litres) which is referred to in Rev. V 19-21 might be equal to the total of the Item A figures plus the amount of cereals designated as **še é-kin-gá** (Item F: Rev. V 16-18). The meaning of **še é-kin-gá**, however, is not as yet known to me. The figure in Rev. V 19-21 is again attested in CT VII 8 [BM 12926], the final record of the income and expenditures of cereals in Girsu in the same year (**níg-ŠID-ak še-kilìb-ba šà-Gír-su^{ki}**). The amount reaches about 85% of the grand total income of Amar-Suen 2 (**99,595 gur 52 sìla [27 gur$_7$ 2,395 gur 52 sìla]** : 29,878,552 litres).

Item B: gú-gal(-gal) The complete expression **gú-gal-gal** occurs in Obv. I 5, Rev. IV 18 and VI 12, while the abbreviated form **gú-gal** is referred to in Obv. II 13. But the principle observed in many other Ur III texts is that **gú-gal-gal/gú-tur-tur** is used at the word's first occurrence, but **gú-gal/gú-tur** at the second occurrence and thereafter. Although it has been assumed that GÚ.GAL.GAL and GÚ.GAL represent two different kinds of legume in Hittite texts [Hoffner 1974, 95-6], this is not substantiated in the 3rd millennium B.C. Mesopotamian sources.

Item G: še-ŠUKU-ra engar The term denotes the barley which was distributed to "cultivators" (**engar**) and their subordinates (**dumu-da-ba, dumu-gu$_4$-gur**). The **še-ŠUKU-ra engar** figures recorded in *CT* X 18-19 occur again in *MVN* II 191 of the same year [Maekawa 1984, 53].

The Ur III "cultivator" managed the domain unit of 6 to 8 **bùr** in area. A principle in Ur III Girsu was that a plot of 6 or 12 **iku** with a domain unit of 6 to 8 **bùr** was specially reserved for the "cultivator" (**ŠUKU engar**: "allotment (land) of the cultivator"). The barley to be allotted to the "cultivator" (**še-ŠUKU-ra engar**) seems to have come from the **ŠUKU engar** plot.

In Ur III Girsu, the administration surveyed the public land just before harvest so as to assess the expected amount of yield from the land. The so-called "round tablets" seem to be records of the results of the survey [Maekawa 1984, 83-4]. I assume that the amount of the **še-ŠUKU-ra engar** barley was also determined at this survey so that the amount, which is often represented as the integral **gur**-figure in Ur III texts, approximates the actual yield from the reserved **ŠUKU engar** plot of 6 or 12 **iku**.

The term **še-ŠUKU-ra engar** also points to the barley which was distributed to "cultivators" in the months so distant from the harvest season.

Remarks to Table 3 (BM 25292 and BM 23585)

Item C: gán-UDU (gán udu ?) I have interpreted the term **gán.UDU** as **gán udu** ("plots (of barley) for sheep (where sheep had grazed young barley buds)" [Maekawa 1982, 96; 1984, 83]. BM 19971 (Maekawa 1982, Text 16) demonstrates that the yield designated as **še.UDU** came from the **gán.UDU** plot. The term **še.UDU** should be distinguished from **UDU.SAR (lu.SAR)**. The latter term (e.g. N 407 [*Revue d'Assyriologie* 55, 94]) is an abbreviation of **lu-úb.SAR** (*laptu* : turnip).

I still hesitate to adopt the interpretations of **gán.UDU** and **še.UDU** as **gán-lu** ("plots of turnip") and **še lu** ("(a mixed yield of) barley and turnip").

Remarks to Tables 4 and 5 (*TuT* 1)

1. For collations of this text see Pettinato & Cagni 1974, 200.

2. **nu-bal** (Table 5) This term might be translated as "(the cereals have) not as yet been delivered (to the administration)".

REMARKS ON THE CULTIVATION OF SESAME AND THE EXTRACTION OF ITS OIL

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In 1968, F.R. Kraus published in *Essays in Memory of E.A. Speiser* (=JAOS 88/1 = AOS 53) his article "Sesam im alten Mesopotamien", where he showed that the etymology of the Akkadian word *šamaššammū* and the textual information about its cultivation are compatible with the identification of *šamaššammū* with sesame (rather than linseed, as held by others). Here, I would like to make some additional observations on "sesame", not discussed by Kraus, but corroborating his point of view.

In present-day Iraq there are two possible seasons for growing sesame:
normal - April to June (Harvest: September and October)
early-planted - mid-March (Harvest: mid-July)[1]
Can we find these seasons in Old Babylonian texts? We will give a list of dated rentals of fields for the cultivation of sesame (sometimes together with other crops). The date of the rental is the *terminus ante quem* for sowing sesame, we assume.[2]

Month I: YOS 12 484, 502.
Month II: YOS 12 215, 543, 286, 490; YOS 13 417, 494; BIN 2 91; Haverford Symposium 230 No. 3.
Month III: YOS 8 173; YOS 12 174, 220, 492, 493, 534; BE 6/2 124; BIN 2 79; TCL 1 141; YOS 13 372; BIN 7 177; TJDB 94 MAH 16.531; JCS 5 82 MAH 16413, 84 MAH 15982, 89 MAH 15909, 90 MAH 16180, 92 MAH 15890.
Month IV: YOS 12 105, 298, 545; Boyer, CHJ 23 HE.193; Grant, *Smith College Documents* No. 264; RA 27 83f.; JCS 5 88 MAH 15985; YOS 13 510, 528; cf. AbB 1 102.
Month V: YOS 12 494; TJA 74ff. UMM H 13.
Month VI: YOS 12 300.
Month VII: ZA 36 95; TLB I 214.
Month VIII: none.
Month IX: none.
Month X: YOS 12 550.
Month XI: YOS 12 554; RA 12 149; RA 72 150.[3]
Month XII: YOS 12 328, 385, 480; TJBD 96 MAH 16.429. Cf. VAS 7 27:11-15 and AbB 7 154:18f.
Month XIIa: YOS 12 398; Riftin 41.

Months XI-XII and months II-IV have a higher density than the other months, so the contracts dated to XI-XII could refer to "early-planted" sesame and those dated to III-IV concern "normal" sesame. Dr. G. van Driel (Leiden) pointed out to me that the few Neo-Babylonian and Persian texts referring to sesame seed (for sowing) are dated to months III, IV (=normal ?) and XII (=early ?).[4]

We actually have in Akkadian some references to "early" sesame (**še.giš.ì** *harpum*)[5], and the early sowing was apparently called *harāpum* D in Akkadian.[6]

The planting of sesame was called *epēšum*, lit. "to make, to do", in Akkadian,[7] and a field planted with sesame is *nēpešēt šamaššammī*.[8] Unique is the phrase "The 2 PI, 3 seah, of sesame which you sent me I sowed (*az-ru-ú*), 7 sila per iku".[9] The verb *zarûm* "to sow seed broadcast" is almost never[10] used for seeding. Mostly it means "to winnow".

The harvesting of sesame (*nasāhum*, lit. "to tear out") takes place in the 7th month (Kinunum), says a Mari text; this is October.[11] A text mentioning harvesters (*nāsih* **še.giš.i**) is dated to month VIII.[12] This period as harvesting season is confirmed by some Neo-Babylonian texts.[13]

"Sesame makes stringent demands for precision in timing the harvest. If the crop be permitted to stand too long on the field, the seed will fall out of the pods and become lost."[14] This unhappy eventuality is called "falling" in Akkadian (*maqātum*), as F.R. Kraus already saw in his seminal article on sesame.[15]

For the yield of sesame, see Butz 1979, 383-386.

After the harvest, the sesame can look "plump" (*kabrūtum*),[16] "white" (*peṣūtum*; only Neo-Babylonian),[17] or can be "excellent" (*bunnûtum*)[17a], "second-class" (*gurnum*),[18] "sweet" (*matqūtum*).[19] Other adjectives refer to specific treatments of the sesame: "dry" (*šābulūtum*; in medical texts),[20] "wet" (*raṭbūtum*, written A = **duru$_5$**),[21] "pressed" (**bára.ga**),[22] "crushed" (*pahṣūtum*),[23] "powdered" (*sīkūtum*),[24] "..." (*dīkūtum*).[25]

Extracting oil from sesame seeds can be done in three steps, according to a French handbook written in 1902: "On fait subir aux graines trois pressions, deux à froid, une à chaud; les deux premières donnent de l'huile comestible;
- la première, dite de *froissage*, est estimée à peu près autant que celle d'olive plus fine. On l'emploie aussi en parfumerie;
- les qualités moyennes servent à l'éclairage et à la lubrification des machines.
- L'huile de troisième pression ne peut servir qu'à la fabrication des savons."[26]

It would be most useful to have a description of the traditional techniques used in the Near East. The only one that I could find does not help us much in elucidating the ancient methods, but at least the passage can be quoted: this is what Petermann saw in "Sûq esch Schiuch", a Mandaean village:

"Ein ander Mal ging ich mit dem Priester zu einem Sesamöl-Fabrikanten, und sah, wie der Sesam zuerst gewaschen wird, damit die Hülsen von den Körnern abgehen; dann wird er auf einen Ofen gelegt, der unten gelinde geheizt wird, um ihn zu erwärmen, und endlich kommt er in eine Mühle, die von einem Pferd oder Ochsen gedreht wird. Durch das Reiben zwischen den beiden Mühlsteinen wird das Oel ausgepresst, welches unten in ein Gefäss geleitet wird."[27]

Certainly atypical, but still instructive for us, is Lady Drower's description of the preparation of the sacred oil (*misha*) of the Mandaeans:

"For this he roasts some sesame over the fire, then places it with the flesh of dates in a mortar and pounds the two together, sounding his pestle against the sides of the mortar. Then, removing the pulp from the mortar little by little, he strains it by placing some into a corner of his ritual robe and squeezing it through the linen into a bowl. When this pounding and straining are ended, the *misha* is transferred to a bottle, and then a little of it is poured into small drinking-bowls."[28]

Or, elsewhere:
"The sesame was cooked a little over a fire, its husk was removed, and it was then placed in a mortar (*hāwan*) and pounded, together with some dates (...)".[29]

I dare not go into the question as to how the Babylonians extracted their oil, as long as I have no clear account of the traditional local techniques. But it will not be out of place to present the Babylonian terms.

The two verbs in Akkadian for extracting oil from sesame seeds are *halāṣum* and *ṣahātum*. The Chicago Assyrian Dictionary (CAD) suggested two techniques for extracting oil from sesame seeds:
- *halāṣum*[30], which applies light pressure and probably uses a sack through which the oil oozes out.
- *ṣahātum*[31], a term also used in connection with the pressing of wine, which is also performed by the *ṣāhitu* and yields the oil usually called *šamnu*.

On *halṣum*-oil, Sumerian **i.bára.ga**, CAD remarked: "Sum. **bára.ag** could be taken to indicate that a sack (**bára**) was used to extract the first and best oil from the sesame seeds".[32]

Six years later, commenting on the verb *ṣahātum* "to extract oil", CAD wrote: "The verb seems to refer to the whole process of obtaining oil from sesame and, in late texts, a type of wine from grapes. The specific translation "to press" is to be abandoned, since sesame oil is obtained by boiling the seeds and skimming off the oil and not by pressing the seeds. (....) This suggests the more restricted meaning of drawing this liquid into vessels, which also fits the operations performed on wine and sesame oil. As to the processing of sesame, the verb *halāṣu* used in this connection could describe the roasting and grinding of the sesame seeds (see *ṣāhitu*), as well as the straining of the liquid through a cloth, while *ṣahātu* could refer to the final stage of skimming, and filling the jars, and be used by extension for the entire process."[33]

Lastly, CAD on the *ṣāhitum* "preparer of sesame oil": "The characteristic equipment of the *ṣāhitu* were the oven in which he roasted the sesame seeds and the millstone on which he ground them into a pulp which was mixed with water and boiled in order to extract the oil".

Dietlinde Goltz (see note 30) does not believe in the boiling of seeds, but she does not know how to distinguish *halāṣum* from *ṣahātum*. A complicating factor is that *halāṣum* is also a verb used for treatments of flax, hair, wool, and even metal.[34] During the discussion of our Group it was suggested by Dorothea Bedigian and others that we could possibly distinguish two techniques:

- pounding the sesame seeds in a mortar (see below, *esittu*); the oil dripping from the resulting cake is the best oil (*halāṣum*);

- crushing the (warmed) seeds in a mill (see below, *erû*) and extracting the sesame from the pulp (*ṣahātum*).

Hardly less confusing are the various Akkadian words for "(sesame) oil":

- *šamnum*, the general word for any oil, but demonstrably sesame oil in a number of cases.[35]
- *šamnum halṣum* or *hilṣum*, obviously the oil resulting from the *halāṣum* treatment.
- *ellum*, according to the dictionaries specifically "sesame oil". The word occurs in two Old Babylonian texts as *e-li-im*, *e-la-am*[36], which suggests a word *elum*. In later tradition the word was etymologized as *ellum* "pure". The Sumerian words for "finest oil", **ú.li** and **ì.li**, also suggest a word with one *l*. These words occur only in literary texts, as does Akkadian *ulû*. It crossed the minds of some participants at our meeting that *el(l)um* could be etymologically related to Latin *oleum*, Greek *elaion*, "olive oil" or "any oil substance"; and ultimately our word "oil". This suggestion gains unexpected support from Hartmut Waetzoldt's contribution to this issue of the *Bulletin*.

The following tools are used in processing the sesame:

kannum ša ṣahāti, A.32086:1[37].

na$_4$ *erû* **ì.giš** / **na$_4$**.HAR **še.giš.ì**, A.32086:2 / BIN 7 218:4.

esittu **ì.giš** / **giš**.KUM **še.giš.ì**, A.32086:3 / YOS 12 342:2.

dug.šagan! **še.giš.ì**, YOS 12 342:1.

maṣhattu(??), CT 8 38a:5,7[38].

mašhalu, AMT 1, 2:14(=BAM 5 494.i.39'): the "dust" (*eperu*) of sesame remains in this sieve.

The residual cake that is left after oil expression is the "oil cake", known in the Near East as *kus(u)b*; *kusup* in Iraq[39] and *ksébe* in Syria.[40] It is used as food for cattle.[41] We find this oil cake and the very word *kus(u)p* back in Akkadian *kupsu*; its Sumerian equivalent is **duh še.giš.ì**, lit. "draff of sesame".[42]

NOTES

1 Poyck 1962, 42, using unpublished sources.

2 I relied upon the Übersichtstabellen in the thesis Mauer 1980, with a few additions.

3 Rental *ana* **še.muš$_5$** ("late barley" - not **še gú** !) *ù* **še.giš.ì**.

4 Strassmaier, *Nabonidus* 226 (Month III), *Cyrus* 27 (Month XII); GCCI, II, 281 (Month IV).

5 JCS 17 (1963) 82f. No. 8 (PUL 199); CT 39 20:137. Sumerian **nim**; cf. Landsberger 1926, 168 (7.c).

6 ARMT 13 39:10f.

7 E. Grant, *Haverford Symposium* (1938) 203 No. 3:10; BE 6/2 124:7; AbB 1 102:13; PBS 7 7:6.

8 BIN 7 56:4, cited CAD N/2, 167b *nēpeštu* 1.c. Also in TCL 11 188:4 (collated; RA 70 90).

9 Christian 1969, 31ff No. 9 (=A.7460), lines 4-8 (OB letter).

10 AHw 1516b, 2. "(aus)säen", gives two certain Assyrian references.

11 Kupper 1973, 269, with further evidence (note 16). Also AbB 7 152:5 (date 5.VIII).

12 VAS 9 22.

13 We see that deliveries of sesame, obviously after the harvest, are made/expected by/from the farmers (*errēšu*) during the following months: VI (*Nabonidus* 883), VII (*Evil-Merodach* 11; *Nabonidus* 167, 791; *Cyrus* 166 [in l. 2 ITU.DUL - collated by W.H. van Soldt]; Speleers, *Receuil* 291), VIII (*Nabonidus* 362, 640, 644, 725, 802; *Cyrus* 70, 204), IX (YOS 17 314), X (YOS 17 326). I owe these references to G. van Driel.

14 A source used by Poyck 1962.

15 Kraus 1968, 118, F.

16 AbB 9 127:10; M. Burke, RA 55 (1961) 210 note 7 (OB).

17 BIN 1 11:19; YOS 3 180:6; YOS 17 209:4. Butz 1979, 285 note 84 writes on black and white sesame.

17a BAM 4 409:21 (medical text).

18 ARM 22 276.ii.3,9,15, etc.; YOS 5 204:3.

19 St. Dalley, OBTR no. 23:14; cf. *1* **sila$_3$ ì.giš** *matqu*, 11. In *Sumer* 1(
(1960) p. 18 SH.113:1 **a.šà** *ma-at-qú-tu*.

20 AHw. 1120b, 1.

21 ARMT 11 No. 77:2 with p. 134f.

22 Akkadian *halṣum* (or: *hilṣum* ?). ARM 22 276.ii.2,34,40, etc.; YOS 5
204:1?

23 YOS 12 433:13.

24 ARM 22 276.iii.42, iv.12,20. CAD S *sīku* A "powdered, crushed".

25 ARM 22 276.ii.6,14, iv.22.

26 Janville 1902, 45.

27 Petermann 1861, 129.

28 Drower 1956, 247.

29 Drower 1937, 133, with Plate 23*b*.

30 *halāṣum*: Goltz 1974, 38f.; M.L. Burke, ARMT XI (1963) p.134; H.
Petschow, *Mittelbabylonische Rechts- und Wirtschaftsurkunden der
Hilprecht-Sammlung Jena* (1974), p.103.

31 *ṣahātum*: Goltz 1974, 38f.; Dalley 1980, 56 note 16. Cf. M. Stol, AbB
9 (1981) p.43 ad No. 58. Also in YOS 13 359 (10 days for 1 kor of
sesame), 444 (5 seah of sesame yields 1 seah of oil; in 10 days). Note
PBS 8/2 221: 2 PI of oil(??) (**še.giš.ì**) from 4 PI, 4 **bán**, 2 **sila$_3$ še.
giš.ì**; BIN 7 158:11-12: **60 sila$_3$** of sesame; its oil is 12 **sila$_3$** (in
both texts no verb).

32 CAD H (1956) pp. 40b and 51b.

33 CAD Ṣ (1962) p. 61.

34 See CAD, AHw, and Durand 1983, 132-5.

35 Syllabic *šam-ni* in *Nabonidus* 22:12, 692:3, 777:4,6 (Neo-Babylonian).
For containers (*nēsepu*) of Ì.GIŠ: GCCI I 186; YOS 17 366.

36 In UET 5 73 (a letter) and BAM 4 393 (=HS 1883) (a medical text). See
also Landsberger 1968, 69f.

37 A.32086, an Old Babylonian contract in the Oriental Institute, Chicago,
is published by R.M. Whiting and the author below, pp. 179-80.

38 CAD M/1, 323b, considers this a by-form of *mashartum* (a container for
oil) occurring in the same text. J.-M. Durand independently thought of
maṣhatum, "vase où l'on presse l'huile" (ARMT 21 p. 273 note 31).

39 Meissner 1901, 173; cf. Meissner 1904, 747.

40 Barthélemy 1935, 716, "marc ou torteau de sésame".

41 Cf. Löw 1924, III, 11, with much more evidence on *kusup*.

42 See CAD and AHw; also UET 5 522:9, 588:1, 20. "Flour of dried (UD.DU
= *šābulu*) sesame draff" in BAM 2 124.iii.48. For **duh** = *ṭuhhū* "draff"
see Stol 1971, 169ff. -- See also R. Labat, MDP 57 (1974) 257, on *a-
da-pa šá* ŠE.GIŠ.Ì in his no. IX v.9.

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BEANS, PEAS, LENTILS AND VETCHES IN AKKADIAN TEXTS

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General

Barley and emmer were the main crops in ancient Mesopotamia. Other crops, less important, were called *ṣihhirtu*, lit. "small"; they are the "minor crops".[1] In Aramaic they were called *qiṭnit*, with the root *qṭn* "small". The Sumerian term is **še.níg.tur.tur** and we learn from some recently published texts that these minor crops were *sahlû* (**zà.hi.li**), "water cress"[2], *kibtum*, "wheat", **gú.níg.àr.ra**, "vetch", but here "lentil(?)".[3] It is possible that in a bilingual literary text the major crops are called **še.gal.gal** = *še'um rabûm*; they include "white" barley, "black" barley, (ground) emmer. The minor crops are **še.TUR.TUR** = *še'um ṣehherum* and include *hallūru, kakkû, kiššanu*. The "(ground) emmer" in this list (and other grains in similar passages) poses some problems that we will not study; maybe this also belonged to the "minor crops".[4]

Gudea distinguished between **gig**, **zíz** and **gú.gú**, "wheat, emmer and various pulses"[5]; the Hendursanga Hymn **gig**, **zíz** and **gú.gal**[6], when describing all crops on the fields.

Concentrating now on the Old Babylonian period, we note the following: The pulses were grown on fields and we have them all together on two small tablets from Shemshara, where we read about fields for *matqūtu* (a kind of sesame ?)[7], *appānu* (otherwise attested only in the Mari texts), **gú.gal**, **gú.tur**, and *kiššanu*[8]. In Babylonia proper we only find **gú.gal** and **gú.tur** out of these crops; **gú.níg.àr.ra** is attested only a few times.

Gú.gal = *hallūrum* is best known. In rentals of fields sometimes sesame and **gú.gal** are mentioned together; sesame is a summer crop.[9] Barley, sesame and **gú.tur** are named in one breath in rentals of field from Susa (Elam).[10] There are big differences in the "Zahl-Termin" in these contracts (generally months V or XII): are they winter *and* summer crops?

Other texts give us information on the seasons when the fruits of these crops are available. Many texts from Mari inform us of the "King's Meal" (*naptan šarrim*; "repas du roi"). They have been studied in a dissertation by Ronald R. Glaeseman.[11] On the king's table appeared **gú.gal**, **gú.tur** and *appānu*.[12] Studying Glaeseman's Appendices, one discovers that the supply of these products was nil or very low in particular months:

Kinūnum	-	Dagan (VII-VIII)*	for **gú.gal**
IGI.KUR	-	Dagan (VI-VIII)	for **gú.tur**
IGI.KUR		(VI)	for *appānu*

[*Month VI is our August-September; VIII is October-November]

A group of texts from Babylonia proper records the delivery of **gú.gal** *ana zērāni*, "as seed(s)". Most of these texts are dated to months VI-VII[13], one to month V[14] and one to month VIII[15]. According to D.O. Edzard, this means that the giving (or borrowing) of these products *ana zērāni* "as/for seed(s)" precedes the sowing[16]. If this is true, the **gú.gal** would be a winter crop.

> The sowing of lentils and chick-peas for winter cropping takes place in the month Aylūl (VI; September); the harvest is in 'Aīyār (II; May), according to Ibn Waḥšiyya[17]. In Palestine the chick-pea is often cultivated in summer, rarely in winter[18]. The broad bean is another winter crop in Iraq and Palestine.

hallūrum

The most important pulse in ancient Babylonia was the **gú.gal**, lit. "big pulse"; in Akkadian *hallūrum*. This plant is commonly identified with the chick-pea (*Cicer arietinum*). This identification finds some support in the use of the chick-pea as a weight unit in the Near East and in a modern similar sowing practice. We will first adduce these parallels, but discover later that Akkadian *hallūru* can hardly be the chick-pea.

It is interesting that the word *hallūru* in later periods was used as a specific weight; even in Aramaic[19]. I would like to point out that this is still the case in Iran: "The seed is named 'Nakhud', the name for an Iranian weight equal to 1/144 ounce avoirdupois. The seeds weigh, on an average, 5 grains each"[20]. The *nakhud* (or: *nochod*) is the chick pea.

Another interesting parallel is that **gú.gal** is sown by "throwing" (*nadûm*) according to a recently published Old Babylonian contract[21]. This "throwing" could be the Arabic *leqāṭ* "Fallenlassen", the method of sowing chick-peas in Palestine according to G. Dalman[22].

Excursus The Akkadian word *hallūrum* seems to have survived indirectly in Syriac *ḥurlā* (Löw 1924, II, 437; Lathyrus) and directly in Persian *ḫullar* (and variants), apparently an obscure word in Persian, generally meaning "pea" (not "chick-pea"). See the dictionaries of Junker-Alavi, p. 280a; Steinglass, p. 471a; Eilers s.v. Erbse: frische grüne Erbse, p. 298b. Polak 1865, II, 138 (cf. I, 122) wrote: "Erbsen (**chāller**), welche klein bleiben, herb und holzig schmecken". The Arabic word for the chick-pea, *ḥummuṣ*, is a loan from Aramaic *ḥimṣā*. Berossos tells us that the Babylonians grew the crop *ōchros*, a word that has been translated in various ways. The lexicographer Sergius identified Greek *ōchros* with Syriac *ḥemṣa*[23]. Was Berossos referring to the chick-pea?

There are some grave problems in identifying **gú.gal** = *hallūrum* with the chick-pea. Botanists present at our meeting found it hard to think of the chick-pea being cultivated during summer or even winter in a land like Southern Iraq. On the philological side, the Old Babylonian texts from Mari and Shemshara pose a problem. There, we find the crop *appānu*[24], a word that certainly is etymologically related to (later) Hebrew *'āfōn*,

without any doubt the chick-pea. In fact, Akkadian *appānu*, lit. "nosey", aptly describes the chick-pea, looking like the tip of a nose. Now, *appānu* is mentioned in those texts together with **gú.gal**, so **gú.gal** cannot be the chick-pea, if *appānu* is.

The broad bean (*Vicia faba*) seems to be left as the only remaining possibility for **gú.gal** = *hallūrum*.

The Hittite texts distinguish GÚ.GAL from GÚ.GAL.GAL; according to H.A. Hoffner "chick pea" and "broad bean"[25]. The Old Babylonian lexical tradition also shows this distinction[26], but **gú.gal.gal** does not occur in OB economic texts or letters. It does occur in Ur III texts, where it is demonstrably identical with simple **gú.gal** (thus K. Maekawa).

gú.gal.níg.àr.ra

A second pulse, attested in one Old Babylonian text, poses a problem. This text is a letter about cultivating fields with barley (**še**), sesame (**še.giš.ì**), chick-peas (**gú.gal**) and this **gú.gal.níg!.àr.ra** [the text offers **gú.gal.A.àr.ra**, which is certainly a mistake[27]]. The areas to be cultivated are 36, 18, 12, 6 *ikû* respectively. This makes an artificial impression; rotation (barley vs. other crops on one field) is excluded, and I think that we have here an exercise in writing letters ("school letter"). The mistake and the very general and repetitious contents of the letter also point in this direction.

A **gú.gal.àr.ra** is known from earlier periods; cf. Deimel, ŠL 106, 151 etc.; Limet 1982, 257: 'sorte de semoule des pois chiches'. And a **gú.àr.ra** exists in earlier texts: RA 10 (1913) after p. 62 Pl. II No. 14.i.12.

kakkû

The Broad Bean(?) (**gú.gal** = *hallūrum*) is often followed by **gú.tur**, lit. "small pulse"; in Akkadian *kakkû*[28]. The first problem is that *kakkû* has a second Sumerian equivalent, next to **gú.tur**: **gú.níg.àr.ra**, which is also equated with *kiššanu* "vetch".

It is clear that in later texts *kiššanu* is the first and main Akkadian equivalent of **gú.níg.àr.ra**; bilingual Standard Babylonian texts show this.[29] The only evidence for an identification of **gú.níg.àr.ra** with *kakkû* in the earlier Old Babylonian period could come from the school letter just discussed. We expect in that letter **gú.tur** after **gú.gal** (as in another school letter[30]), but we find **gú.gal.níg!.àr.ra.** Is this a mistake for **gú.níg.àr.ra** = *kakkû*?

I have the following suggestion in order to explain the two identifications[31]

> **gú.níg.àr.ra** = *kakkû*
> **gú.níg.àr.ra** = *kiššanu*:

My suggestion is that only in the Old Babylonian period **gú.níg.àr.ra** denoted *kakkû*. It was occasionally used instead of **gú.tur** = *kakkû*.

Arguments: 1. It never occurs together with **gú.tur** in one text;
2. In two instances, it follows **gú.gal, as gú.tur** normal does.[32]

Now, there was no Sumerogram for *kiššanu* during this period; in Alala (in the Amuq Plain) they invented for *kiššanu* the pseudo-ideogr ***zi-rum*** (see below). With the introduction on a large scale of the horse the Near East during the late Old Babylonian and the Middle Babyloni ("Kassite") periods, the vetch (*kiššanu*)became increasingly important as fodder crop; it was now grown in Nippur.[33] From the Middle Babyloni period on, **gú.níg.àr.ra** was used only and exclusively as Sumerogram fo *kiššanu*. And **gú.tur** denoted the *kakkû* only. During the Old Babyloni period, both Sumerograms were used to denote *kakkû*.

What crop could **gú.tur** = *kakkû* be? For a long time, the common p (*Pisum sativum*) was excluded as a possibility. Dalman once wrote "I Altertum fehlt die Erbse"[34]. But reportedly its seeds have been found b archaeologists and we now have to look for the common pea in the texts Let us assume that **gú.tur** is the common pea. If so, the seeds of thi "small pulse" should be smaller than those of the "big pulse" (**gú.gal**). They are indeed smaller than those of the broad bean. Also, the seeds o the common pea are not smaller than those of the chick-pea: they are "5 m or more in diameter", while those of the chick-pea are 5 - 12 mm. Hardly difference. Or do "big" and "small" refer to the importance of bot crops, not their size? Economically, **gú.gal** is indeed more important tha **gú.tur**.

Another suggestion is that **gú.tur** = *kakkû* are lentils (*Lens culinaris*). The seeds of the lentil are indeed much smaller than those of the broad bean or chick pea (see Van Zeist, p. 35; Charles, pp. 56-7). The lentil i still cultivated in Mesopotamia and Syria. It is a winter crop in Iraq. It is eaten for breakfast in Iraq[35] and Persia.[36] Lentil seeds need to b roasted or ground because they are indigestible if the outer skin of the seeds is not removed[37]. Although at our meeting the botanists informed u that roasting or grinding is not absolutely necessary, this would fit the Old Babylonian Sumerogram **gú.níg.àr.ra**, "pea for grinding" (**níg.àr.ra** = *samādum*). Many scholars have identified **gú.tur** as the lentil, but the identification has never really been proved. Cf. recently Hoffner 1974, 95f. "Lentil" is in Arabic and Hebrew *ʿadas*, *ʿadāš*; in Aramaic *ṭᵉlofḥā*.

kiššanu

For the identification of Akkadian *kiššanu* we are greatly helped by its cognates in the modern Arabic dialects. Barthélemy in his dictionary of Syrian Arabic gives the word *kǒšne* "vesce noire, ers"[38]. Dalman tells us that the word for "Futterwicke" (*Vicia sativa*) in the Aleppo region is *kišne*.[39] We owe a description of the cultivation of "Wicke" (*əlkəšen*) in Northern Mesopotamia (Ḥalanze) to Jastrow.[40]

In other dialects this vetch seems to be called *kirsanni*[41], a by-form of Arabic *karsenna*. Dalman distinguishes this vetch from the *kišne* of Aleppo and calls it "Knotenwicke (Kamellinse)" (*Vicia ervilia*), the bitter vetch.[42] From the descriptions of their cultivation, treatment and use, one gets the impression that *kišne* and *kirsanni/kirsenne* are identical.

In the "classical" Arabic scientific literature there seems to be much confusion between *karsanna* and *kuršna*; Syriac *kūršnē* is identified with Arabic *karsanna*.[43] In A. Barthélemy's and Cl. Denizeau's dictionaries of Syrian Arabic I could not find *kirsenne*. So *kəšen* (Jastrow) and *kirsenne* (Dalman) both seem to denote the same fodder plant.[44]

This vetch, whatever its name or dialectal form, is a fodder plant, widely cultivated. Now we have to distinguish *two* cultivated fodder crops; we quote Weulersse:

"Gesses [=lathyrus] et vesces [=vetch], au contraire, ne sont utilisées que pour la consommation locale; la première, *kersené* en Arabe (Lathyrus cicera), donne une graine très dure qui est réservée à l'alimentation des chameaux; la seconde -- *djibâni* -- (Vicia sativa) sert à la nourriture du gros bétail, en fourrage ou en grains. L'une et l'autre poussent sur les terres les plus médiocres et réclament peu de soins."[45]

So Weulersse tells us that the grain of *kirsenne* is "very hard" which would make grinding imperative. His second crop is well-known and called *ǧilbān* in Arabic (Aramaic *gilbōnā*). Barthélemy writes: *djəlbǎn* "gesse cultivée, jarosse, vesce brune assez semblabe à la lentille qu'on donne aux moutons et en hiver aux pigeons".[46] This is the chickling vetch, blue vetch, grass pea (*Lathyrus sativus*), in Iraqi Arabic *hurṭumān*.[47] Its cultivation is mentioned several times by Ms Sweet in her book on Tell Toqaan[48], but she does not give its Latin name (simply *jilbaan* "vetch"). I have the discomforting impression that the French and Latin terminology in Weulersse should be the other way round.[49]

Let us now study the Akkadian word *kiššanu* (often *kiššenu*) in the light of this evidence.[50] The word occurs very often in ration lists from Old Babylonian Alalakh (in the Aleppo area). Perusal of these texts shows that *kiššane/kiššenu* (and its pseudo-ideogram ***zi-rum***) was used as fodder for oxen[51], horses[52], donkeys[53] and even birds.[54] When personal names follow the rations, human consumption may be meant, but we are not sure of this.[55]

> Lexical texts mention bread (**ninda**) and soup (**tu$_7$**) made of **gú.níg.àr.ra**, but in these (old) traditions *kakkû*, not *kiššanu*, is probably the equivalent of **gú.níg.àr.ra** (MSL 11, p. 162.vi.6; 152:6; 113 1:19).

We know from an Old Assyrian text, not yet known to the dictionaries, that *kiššinu* was winnowed (*zar'um*).[56] Jastrow's "Wicke" (*əlkəšen*) is also winnowed.[57] In Shemshara *kiššanum* was a field crop, together with other leguminosae.[58] This is confirmed by a (later) Babylonian omen[59] and texts from daily life.

The Sumerograms for *kiššanu* are important. We have already met with the singular ***zi-rum*** ("seed"?) in Old Babylonian Alalakh.[60] Normally the Sumerogram is **GÚ.NÍG.ÀR.RA**; the element **NÍG.ÀR.RA** means that the product (**GÚ**) was ground[61]. This would fit the modern *kirsenne* which is to be ground (*ǧrš*)[62]: the Vetch.

Another Sumerogram for *kiššanu* is **GÚ.LAGAB**, lit. "GÚ-block". This will remind us of the "Klösse" (Arabic *da'būl* or *daḥbūr*), made from Bitter

Vetch, water, and barley groats.[63] Sumerologists pointed out, however, that **LAGAB** does not necessarily mean "block".

Our conclusion, then, is that the Akkadian *kiššanu* means "vetch". However, there are two vetches, both fodder crops: the Common Vetch (*Vicia sativa*) and the Bitter Vetch (*Vicia ervilia*). The botanists in our group are strongly in favour of the Common Vetch for *kiššanu*. They cannot imagine that the bitter vetch was cultivated in Southern Iraq.

A Sumerogram **GŰ.ŠEŠ**, lit. "bitter pulse", occurs in Hittite texts. Hoffner identified this with the Bitter Vetch, mainly because both expressions have the adjective "bitter" in common. It was used for human consumption.[64]

Lathyrus

I could not find the Akkadian or Sumerian word for the second fodder crop in Syria, *ǧilbān*, the Chickling Vetch or Grass Pea (*Lathyrus sativus*); in Iraq *ḫurtumān*. For human beings, it is a typical famine crop, causing the disease "lathyrism".[65] There exists an Akkadian word *ladiru*, attested in Assyrian medical texts, always occurring together with **GŰ.GAL**, **GŰ.TUR**, vetch, and flax seed. Its seeds are used in the medical prescriptions. This word *ladiru* (or: *laṭiru*) seems to be Assyrian and in the (late) lexical texts it is equated with *šambaliltu*, a fodder plant occurring as early as the Old Babylonian period.[66] The word literally means "plant-of-fodder"[67] and survived in Aramaic and even in modern Persian where it denotes fenugreek (*Trigonella foenum-graecum*); in Arabic *ḫulba*.

I would like to suggest that the Greek word *láthuros* is the same as Assyrian *ladiru* (*laṭiru*). Greek *láthuros* is a fodder plant, as *ladiru* = *šambaliltu* is. It remains an open question, as to what fodder plant *ladiru* (and even *šambaliltu*) exactly was: Chickling Vetch or Fenugreek.

It is unusual to discover a relationship between Akkadian and Greek words, but in the case of *Wanderwörter* this might be permitted. Elsewhere, I connect Greek *kardamon* with Assyrian(!) *kuddimmu* "cress" (see note 2).

Addendum (August 1985)

After this article had gone to press I found two references to Akkadian **gű.gal** in the Babylonian handbook "The appearance of a plant":

"[If the appearance of a plant] is green like **gű.gal** [....]..., that plant, **ú.lal** is its name". STT I 93:84

This seems to refer to its general appearance.

"If the appearance of a plant is green like the ...-plant[a], its seed is white like **gű.gal**, **ú.aš** is its name; a plant for removing the demon Lamaštu". BAM 4 379.ii.7-8

a) *sah-la-nu* ?

"White" seems to refer to the seeds of **gű.gal** here. The *Flora of Iraq*, vol. III, says on the seeds of the

-- broad bean: dark chestnut when ripe (p. 543);
-- chick-pea: pale to dark brown (p. 507).

So the second reference is in favour of **gű.gal** = *hallūru* = chick-pea.

NOTES

1 So CAD S, p. 174; W., von Soden, AHw, p.1088 s.v. ṣehhertum, 2. "(Ernte-)Nebenfrucht". In Late Babylonian Nippur *ṣahharum*.

2 Cf. M. Stol, "Cress and its Mustard", to be published in JEOL 28.

3 Ellis 1977, 137. Also in YOS 12 203:37. - Old Babylonian *ṣihhirtum* does not include sesame; see now Kraus 1984, 178 section 15. Late Babylonian *ṣahharu* does not include sesame either, to judge from PBS 2/i, 158 and CBS 12980 (diss. M.W. Stolper).

4 The literary text is Cooper 1972, 72f., l. 18.

5 Cyl. B xi.21 with Falkenstein 1949, 71-2 (**gú.gú** = **gú.gal** and **gú.tur**).

6 Edzard & Wilcke 1976, 144:23.

7 Cf. Dalley 1976, p.41 No. 23:11, 13f. (**še.ì.giš** *matqūtum*).

8 Laessoe 1960, p.18; see now the article of J. Eidem, this volume.

9 JCS 5 (1951) 84 MAH 15982 (16.III); YOS 13 414; 494 (9/10.II).

10 CAD K p.58a, f.; diss. Gerlinde Mauer (1980), Übersichtstabelle 3.

11 Glaeseman 1978.

12 Glaeseman 1978, pp.44f., 49 (Table 1).

13 YOS 13 394; 395; 467; 501.

14 YOS 13 392.

15 Riftin 1937, No. 10. - YOS 12 259 (month X) is another type of text.

16 Edzard 1970, p. 63; Hunger 1976, p. 327.

17 El-Samarraie 1972, 68.

18 Dalman 1932, 271.

19 Powell 1979, 101f.

20 Hooper 1937, 99.

21 YOS 13 494:14: *šumma* **gú.gal** *inaddû* **gú.gal-***šunu ileqqû-ma* ...

22 Dalman 1932, 271.

23 Löw 1924, 432, below; but Honein identified the Greek term with *ǧilbān* (Löw 1924, 438).

24 Mari: in the king's meals. Shemshara: on the field, *Sumer* 16 (1960) p. 18.

25 Hoffner 1974, 98f.; in Hittite *šumešša*r.

26 **gú.gal - gú.gal.gal**, MSL 11 146.v.15f.
gú.gal - gú.gal.gal.la, MSL 11 81, Hh XXIV:124f.
tu7.gú.gal - tu7.gú.gal.gal, MSL 11 69, a; 152, 15:3f.

27 Pinches 1917, 730f. - CAD G 151a, GÚ.GAL.A.KUR.RA, is wrong.

28 CAD K 58 "lentil (or small bean)"; AHw 422b "eine kleine Erbsenart".

29 Note, as a contrast, the gloss *ka-ak-ku-ú* to **gú.tur** in a text from Ugarit, PRU 6 (1970) p.19 No. 18:15. In a lexical text is **in.nu gú. níg.àr.ra** = [*tibni kiš-šá-ni*, not *tibni kakkī* (*tibnu* = straw); MSL 11 p.84:227.

30 Greengus 1979, No. 20:12.

31 Source: MSL 11 p.81, Hh XXIV:128f.

32 VAS 7 131:4 and Birot 1969, No. 14:12. - The only other non-lexical OB reference for **gú.níg.àr.ra** known to me is JCS 29, 144 No. 6:12. In that text, **gú.tur** does not appear.

33 BE 14 88; etc.

34 Dalman 1932, p.272, 12.

35 Jastrow 1979, 73-5 sub 40f. (Mossul), and 1981, 445 sub 4f. (Dēr iz-Zor).

36 Polak 1865, 138: "Linsen (addas), behufs des schnellern Garwerdens mit etwas Salsolapflanze gekocht, sind das gewöhnliche Frühstück der arbeitenden Klassen".

37 Guest et al., 1974, 547; Dalman 1932, 264; Sweet 1960, 130.

38 Barthélemy 1935, 720.

39 Dalman 1932, 269, 7. (als Futter für Rinder und Kamele in Nord-Palästina und Syrien angebaut, Wintersaat).

40 Jastrow 1981, 276f.

41 Jiha 1964, 113.

42 Dalman 1932, 269, 8.

43 Löw 1924, 484-6 (=ZA 30 [1915] 173-6); Ducros 1930, 42f. No. 75. In the Neo-Aramaic Ṭuroyo language the word is *kuṣne*; see Ritter 1979, 285.

44 *Pace* Dalman 1932, 269 (7. Futterwicke, *bāḳia*, bei Aleppo *kišne*; 8. Knotenwicke, *kirsenne*).

45 Weulersse 1946, 149.

46 Barthélemy 1935, 116.

47 Dalman 1932, 270, 9 ("Graserbse").

48 Sweet 1960, pp. 70, 73, 75, 77ff., 83, 96, 264 Fig. 21.

49 Note the confusion between *karsanna* and *ǧulbān* in Achundow 1893, 177 No. 104 "Dschulbân".

50 CAD K 456f. "(a leguminous plant)"; AHw 492 "eine Hülsenfrucht, deren Mehl verbacken wird" [why?]. J.N. Postgate rightly observes that t *a* is short.

51 JCS 13 (1959) 19-32 No. 243:26ff.

52 Ibid. Nos. 240:20; 243:28; 244:2; 245:15; 246:29, 37; 249:10; 250:4; 264:28; 261:23; 267:1.

53 Ibid. Nos. 259:7; 265:31.

54 Ibid. No. 266:1.

55 Ibid. Nos. 237; 239; 261:20-25; 280:6. - Also not clear in the Neo-Assyrian text ND 3467:10 (Postgate 1974, 399).

56 Balkan 1974, 39 note 34 (kt g/k 18).

57 Jastrow 1981, 277 sub 9.

58 Laessøe 1960, 18; J. Eidem, this volume.

59 CT 39 16:41.

60 As D.J. Wiseman saw.

61 Explicit in **GŰ.NÍG.ÀR.RA** *sandūti*, BAM 2 159.ii.7.

62 Description in Jiha 1964, 113.

63 Dalman 1932, 269.

64 Hoffner 1974, 99.

65 Still occurring in India: cf. Aykroyd & Doughty 1964, 61-5, wi General Sleeman's account in Appendix 4.

66 Dalley 1976, p. 51 No. 38 (its seed).

67 Cf. the literal meaning "fodder" (Arabic *ʿalaf*) of "alfalfa", lucern

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A NOTE ON THE PULSE CROPS AT TELL SHEMSHARA

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As mentioned by Stol in his contribution to this volume the two tablets SH 113 and SH 105 from Tell Shemshara, published by Prof. Laessøe in *Sumer* 16 (1960) 18, provide a roster of the pulses grown in Mesopotamia in the Old Babylonian period. Since Laessøe published his preliminary survey of the "Second Shemshara Archive", to which these two texts belong, a study of the entire text group has revealed that SH 113 in fact lists all of the possible pulse crops attested at Shemshara. As for the correct identification of these crops I shall not attempt to reiterate ground already covered by Stol and others in this volume, but merely examine this question in the light of Helbaek's analyses of carbonized seeds from contemporary levels at sites in NE Iraq. First, however, it will be relevant to provide a brief summary of the wider context - and especially the date, of the second Shemshara archive.

The first archive (SH 800-945) consisting of the well-known diplomatic correspondence and a number of administrative texts, none of which deals with agricultural produce, was found in Room 2 of the Level V palace in 1957.[1] The second archive (SH (2) 100-203) stems from Rooms 27 and 34 in the same building, and was found by the Iraqi expedition which continued the excavation of the site in 1958-9.[2] A general date for the first archive has never been in doubt: it belongs to the Mari period, to the time of the so-called "Assyrian Interregnum". A detailed historical analysis of the diplomatic correspondence yields an even more exact date, and it may now be considered virtually certain that the archive covers a period of about three years, late in the reign of Šamšī-Adad I, or more precisely his 27th to 30th regnal years.[3]

Writing in 1959, when only part of the second archive was as yet available for study, Laessøe suggested that it dated somewhat later than the first. Subsequent work on the entire material, however, shows that the two archives must be roughly contemporary. It is not possible in this context to present the detailed evidence for a redating, but it may be mentioned that several important persons occur in both archives, and also that the archaeological evidence, as originally noted by Laessøe, is not really conclusive in this respect. Unfortunately more than half the tablets from SH 2 are in a miserable state of preservation and almost worthless, but the archive clearly supplements the texts found in 1957 as many of them concern agricultural products - lists of issues, deliveries, rations etc. - affairs wholly absent from SH 1.

Returning now to SH 113 and 105 we read:

SH 113: (1) *20* A.ŠÀ *ma-at-qú-tu* (2) *20* A.ŠÀ *ap-pa-nu* (3) *10* A.ŠÀ ⌜GÚ⌝.GAL
(4) *11* A.ŠÀ GÚ.TUR (5) *5* A.ŠÀ *ki-ša-nu* *(6) NUMUN ša E-lu*!
(7) *iš-tu Šu-šar-ra-a il-qè*

SH 105: (1) *12* A.ŠÀ GÚ.TUR (2) *12* A.ŠÀ GÚ.GAL (3) *6* A.ŠÀ *ki*!*-iš-ša*
(4) *10* A.ŠÀ *ap-pa-nu* (5) NUMUN *ša* ⌜AGA.UŠ⌝

The reading Elu in 113, 6 is confirmed by a number of unpublished text among them SH 136, 1 which has *E-lu*^{ki}. Likewise AGA.UŠ - "the soldier(s)" in 105, 5 occurs in similar contexts elsewhere. These two texts then d with issues of pulse seeds[4] from Shemshara to a locality nearby, and state tenants. As shown by Laessøe, Shemshara, ancient Šušarrā, was t administrative center for the area called *māt Utêm* - presumably the Ran plain,[5] and the various pulses mentioned in SH 2 texts were according those grown in this general area in the early 18th century B.C., vi GÚ.GAL, GÚ.TUR, *kiššanu*, *appānu*, and *matqūtu*. Except for the problemat *matqūtu*, all of these crop-names are known from other areas of O Babylonian Mesopotamia, and it may of course be assumed that they have t same meaning at Shemshara as elsewhere,but it is still of some interest check the more or less generally accepted identifications independent against the archaeological evidence.

A few miles downstream from Shemshara Iraqi archaeologists excavat the large site of Tell Bazmusian.[6] Ten samples of carbonized seeds we collected from the upper levels, and later examined by Hans Helbaek, w published his results in *Sumer* 19 (1963) 27-35. Samples from Level I which must be roughly contemporary with Level V at Shemshara,[7] contained besides cereals - only lentil and chick-pea, but considering also the n altogether clear stratigraphy at Bazmusian, it could perhaps be assum that the sample of Vetchling or Grass Pea (*Lathyrus sativus*), taken fr Level VII (dated to ca. 2000 B.C.) indicates that this pulse was grown the time of our archive. Two samples apparently consisting only of bro bean (*Vicia faba*) were said to stem from the early Islamic Level I, b were actually found in a later pit in Level IV, and so cannot be entire excluded from consideration. To the evidence from Bazmusian may final be added samples from Tell Qurtas in the Shahrizor region, more or less the same geographical zone, and in a roughly contemporary time range, whe seeds of lentil and bitter vetch (*Vicia ervilia*) were found in a pot.[8]

Especially considering the accidents of discovery such evidence is no conclusive, of course, but it seems significant that five different pulse can be adduced for the five crop names in our texts, and further that th species more or less tally with the identifications proposed by Stol allowing the following, tentative, conclusions:

GÚ.GAL could well be the broad bean, but firmer evidence is needed.

GÚ.TUR which has been suggested as the pea or the lentil, would seem t have been identical with the latter at Shemshara.

appānu could well be the chick-pea.

kiššanu could be the bitter vetch.

matqūtu finally could be identified with the Grass Pea, although I ca offer no etymological connection. Stol cautiously suggests tha *matqūtu* denotes some kind of sesame on the evidence in OBTR no. 23.

But there the word is rather used just as a simple adjective about two kinds of oil (ll. 11 and 14, note the change from the singular *matqu* referring to I.GIŠ (*šamnu*) to plural *matqūtu* referring to ŠE.I.GIŠ (*šamaššammū*)).

In spite of the somewhat precarious nature of these conclusions, they do seem to show that the pulse cultivation in the Zagros foothills more or less follows the general pattern to be observed in Northern Mesopotamia in Old Babylonian times, and that closely synchronic comparisons of textual and archaeological data from the same area will eventually provide us with more exact identifications of the various agricultural products mentioned in our texts.[9]

NOTES

1. See in general J. Laessøe, *The Shemshāra Tablets* (Copenhagen 1959).

2. See the article in *Sumer* 16 mentioned above. Prof. Laessøe has generously suggested that I edit the final publication of all the administrative texts from the two archives, and I hope to complete this work within the next few years.

3. See J. Eidem, "News from the Eastern Front: the evidence from Tell Shemshara", *Iraq* 47 (1985) 83ff.

4. The preliminary reading of MU for NUMUN was later corrected by Laessøe, cf. S.M. Dalley et al., *Old Babylonian Texts from Tell al-Rimah*, p.167 No. 232 ad 1.15.

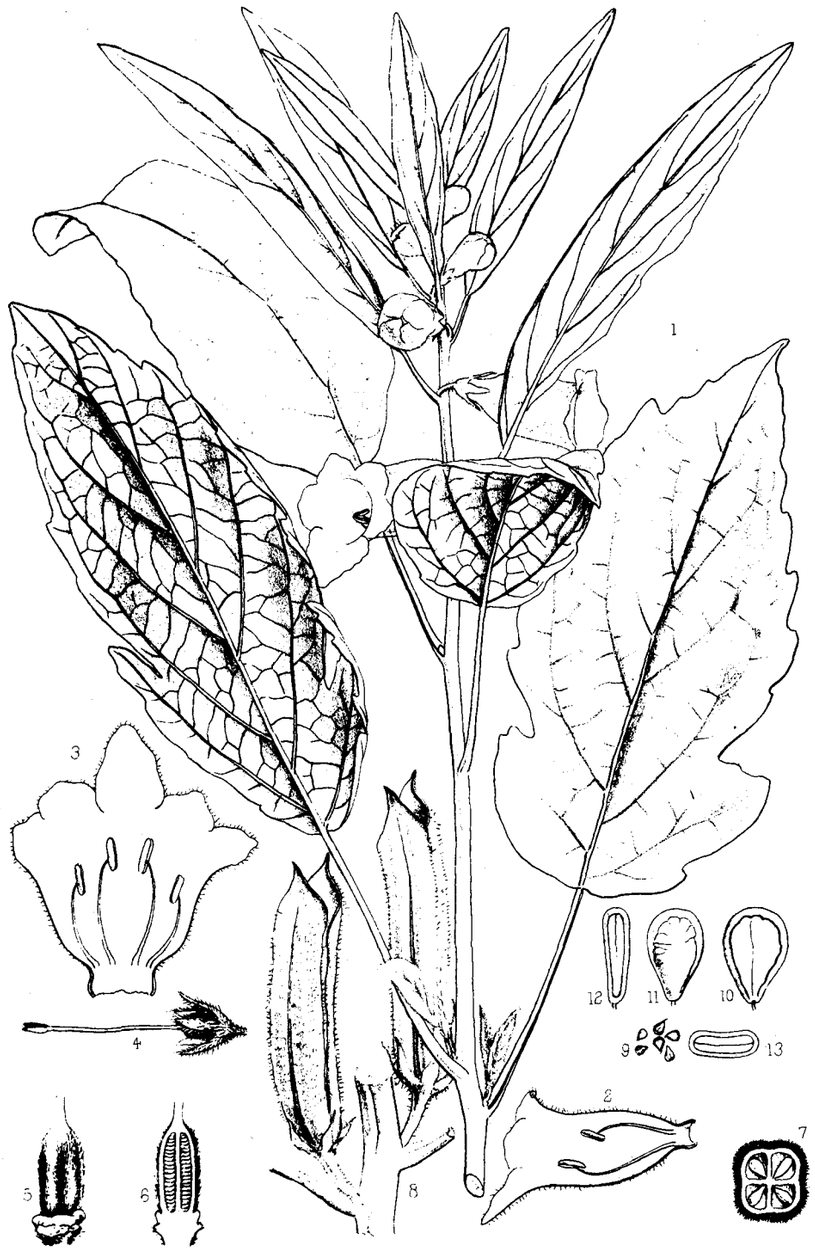
5. Laessøe, *Journal of the American Oriental Society* 88 (1968) 120ff.

6. See B. Abu as-Soof, *Sumer* 26 (1970) 67ff.

7. Ibid. 68ff. Note that the temple shares significant architectural details with the temple at Rimah and the one under excavation at Tell Leilan in north-eastern Syria (cf. *Archiv für Orientforschung* 28 (1981/82) 226ff.).

8. Helbaek, *Sumer* 16 (1960) 79f.

9. I would like to thank the Editors who kindly made most of the contents of this volume available to me in manuscript, and invited me to contribute this note.



SESAMUM INDICUM, *DC.*

Sesame, after R.Bentley & H.Trimen, *Medicinal Plants* (London, 1880)

THE "OIL-PLANT" IN ASSYRIA

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This note is confined to the evidence of the texts written in North Iraq during the Middle Assyrian (1400-1000 B.C.) and Neo-Assyrian (1000-600 B.C.) periods. I have occasionally referred to evidence from the Old Babylonian and Nuzi texts from the same general area, but have made no attempt to consider these as a corpus. As in Babylonian, the Assyrian word for the oil-plant was the plural form *šamaššammē* (stated explicitly in the Practical Vocabulary of Assur, l. 38); in accordance with standard Babylonian scribal practice this is rendered with the logogram **še.giš.i**, in contrast to the early 2nd millennium writing in the north, at Mari, Tell al Rimah and Nuzi, **še.i.giš**. For the benefit of the non-cuneiformists, it may be worth repeating that both these logograms are composed of the Sumerian words (or rather signs) for "corn" (**še**) + "wood" (**giš**) + "oil" (**i**), while the Akkadian term appears to be composed of the two very common words *šamnum* "oil" and *šammum* "plant", i.e. *šaman* + *šammē* "oil of plants" (see Kraus 1968, 115a). This is, of course, embarrassing, because in fact the word is used to refer to the plant, and not its oil. It seems possible to me that in fact the compound word was originally **šamma-šamni*, which underwent a slight metathesis in the course of time, and in any case I propose to translate the word as "oil-plant", regardless of Kraus' valid technical objections, so as to avoid committing myself in advance to a botanical identification.

The "oil-plant" is not to be confused with "plant-oil", often written as the Sumerogram **i-giš** (or in ligature **i+giš**). This logogram, used in both Assyrian and Babylonian texts, is sometimes to be read *šamnu* "oil". However, whereas the logogram itself appears to imply that it was vegetable oil ("oil+wood"), the Akkadian word *šamnu* (of common Semitic stock) is not so specific, since it can, for instance, be applied to pig's fat. The Akkadian word *el(l)u* (on which see Stol, above, p. 122) is also attested as an equivalent for this logogram, and we are therefore frequently uncertain which of the two words is intended. Whichever it is, it is construed as a singular (cf. on *halṣu* below), and there is therefore no chance that it is merely another way of writing *šamaššammē*. In other words, the **oil** is strictly distinguished from the **plant** in the texts, as we should expect.

The processing of the oil-plant

Kraus 1968 lists verbs describing various processes associated with the cultivation and harvesting of the oil-plant, but not the later stages of processing. Information on the traditional techniques of treating sesame in the modern world seems to be very difficult to find, but combining the evidence presented to our meeting by Bedigian and Stol, we can distinguish the following stages leading to the production of oil. The most complete sequence comes from Syria in the 19th century (quoted by Bedigian, p. 160

after *Law's Grocers' Manual*), and it is not difficult to reconcile this with both the other modern accounts and the archaeological and textual evidence for antiquity presented by Bedigian and Stol (see pp. 168-9 and 120ff.).

a. soak in water for 24 hours
b. pound with 20 lb hammer in cemented vessel to loosen husks
c. float kernels off in salt water
d. "broil" seeds in oven
e. grind seeds at mill, catching oil in jar

In Assyrian as well as Babylonian dialect there are two verbs regularly associated with the processing of the oil-plant, *halāṣum* and *ṣahātum*, and Stol's quotations from the CAD (pp. 121-2) demonstrate the difficulties experienced by the philologists in translating these words (and their Sumerian equivalents). Having reconsidered the problem in the light of our meeting and the papers submitted to this issue of the *Bulletin*, I feel that it is now possible to offer a convincing explanation of the terminology, which agrees excellently with the processing of sesame in modern times. First it is necessary to establish certain points:

1. for *ṣahātum* a meaning "press (to extract liquid)" is favoured both by its use for the extraction of wine from grapes, and by the meaning of cognate verbs in other Semitic languages.

2. *ṣahātum* is the process which results in the extraction of oil: the *sahitum* is a **lú.ì.sur**, a term meaning literally "oil-presser". All oil had to be produced by pressing, which is why we do not meet a commodity called "pressed oil" (**šammum ṣahtum*), as this would be tautologous, or "pressed oil-plant" (**šamašš̆ammū ṣahtūtu*), as this would be the residue which has other names (see Stol, p. 122).

3. There is no reason to think that *ṣahātum* or *halāṣum* are alternative processes. On the contrary, YOS 2, 58 (quoted CAD H 40a and now in an improved version, Stol, AbB 9, 58) strongly suggests that they are consecutive processes. The passage is worth quoting: "The *halṣum* oil (**ì.bára.ga**) which you brought me is not good to smell. Let them *halāṣum* the oil-plant in your presence, (then) stay there and let them press (*ṣahātum*) the oil in your presence". That the pressing comes after the *halāṣum* process also follows from the Old Babylonian contract CT 8 Pl.8e, where a big quantity (9 **gur**) of *halṣum* oil-plant (**še.giš.ì bára.ga**) is to be pressed and oil repaid within a month (**še.giš.ì** *iṣahhatu-ma* **ì.giš ì.ág.e.meš**, ll. 10-11). (See also Waetzoldt, p. 85, on this point).

4. As noted above, both oil and oil-plant may be described as *halsum*: **še.giš.ì** *halṣūtu* and **ì.giš** *halsum*. Translators have sometimes failed to observe the difference between the oil-plant and its oil, but in fact the plant was used in its own right, and was not always turned into oil: KAJ 226 lists **še.giš.ì** *halṣūtu* between other dry vegetable commodities such as flour, groats, fine groats, and cummin (*sibibiānu*). *Halāṣum* is therefore a process which can be applied to the seeds of the oil-plant, whether it is intended to use them as a dry commodity or to extract their oil. Since the fact that they have passed through this process needs to be mentioned, presumably it could also be omitted.

If we now compare the cuneiform terminology with the processes attested for the treatment of sesame in modern times, it is clear that *ṣahātum* "to press" represents the final stage (e) above. This was the eponymous activity of the oil-presser (*ṣahātum*), and made use of pestle and mortar, and of a *kannum* - a specialist piece of oil-pressing equipment (cf. CAD K s.v. and Stol & Whiting, above p. 117). *Halāṣum* must therefore refer to some or all of the stages (a) to (d). Our modern reports do not describe the preparation of sesame-seeds for culinary use; it is not clear to me whether stage (d), the heating, was needed if the seeds were not destined for pressing (nor do I know what the term "broil" implies in the quotation from Law), but we may at least assume that removing the husks from the kernels was a stage common to both uses of the seed. I suggest, therefore, that *halāṣum* refers to the recovery of the de-hulled kernels from the surface of the water (which could have been done with a comb-like instrument, a sieve, or even a coarse cloth - hence **bára** in Sumerian), and more generally to the process of freeing the seeds from their husks or "hulls". The corollary of this suggestion has to be that sometimes the seed was used (both in its own right and for oil-production) without being de-hulled. This may sound unlikely, but in fact in India today sesame seeds are used to yield oil in both hulled and unhulled condition (Weiss 1983, 583-4, quoting comparative figures). Given the extra labour involved, it is obvious that the hulling process would only have been adopted because it gave a better product, and indeed Weiss comments (of oil-seed crops in general) that "to provide a high-quality edible oil hulling is recommended" (1983, 540).

To sum up, after harvesting the oil-plant (surely sesame!) was often de-hulled, probably by pounding the seeds and then skimming the loosened kernels off the surface of water, and this process was called *halāṣum*. The product was probably then heated, and either stored as a dry food, "hulled sesame" (*šamašš̆ammū halṣūtu*), or handed on for pressing (*ṣahātum*), which yields "de-hulled oil" (*šamnum halṣum*) and "residue" (*kuspē*). In each case, a less good quality product could be obtained more quickly by omitting the "de-hulling" process.

The Middle Assyrian sources

The Assur Temple Offerings In one of the annexes to the national temple of Assyria at the city of Assur, the German excavators found an archive of some 600 tablets from the reign of Tiglath-pileser I (ca. 1110-1076 B.C.; see Postgate 1980). A few of them have been published, and record deliveries to the temple Steward (*abarakku*) by the governors of the provinces. The contributions were in kind, in four categories: corn (*še-um*.**meš**; probably all barley), honey, "oil-plants" (**še.giš.ì.meš**) and fruit (*azamru*). Various tablets mention such offerings (VS 19, 56; 73; VS 21, 8; 24; Andrae, *Wiedererstandene Assur* Taf. 49a), but VS 21, 21 is particularly important, because it enables us to see the quantities supplied by each of the provinces. 27 provinces are listed; some gave no contributions at all, and only two gave all four categories on this occasion. Despite small breaks, most of the total receipts can be reconstructed. This list is given in litres (taking the arbitrary equation 1 homer = 100 *qû* and 1 *qû* = 1 litre; the margin of error may be as much as 20%):

corn	130,000 l. (+)
honey	1,120 l. (+)
oil-plant	10,057 l.
fruit	4,566 l. (+)

Since the number of provinces making contributions in the different categories varies, it is perhaps more useful to note the *relative* quantities in the two cases where one province supplied all four:

	corn	honey	oil-plant	fruit	total	
Arbail:	23,070	160	900	516	24,646	litres
	93.6%	0.65%	3.65%	2.1%	100.00	% of total
Katmuhu:	18,000	187	540	710	19,437	litres
	92.6%	0.96%	2.78%	3.65%	100.00	% of total

This reveals clearly that the oil-plant was an important commodity, but still far behind the cereals in quantity.

The texts make it clear that these offerings were brought in by boatmen, which suggests that they were sent, in kind, from the regions in question, rather than acquired for cash or by exchange in Assur itself. One might therefore hope to observe regional differences in the types of contributions, but this is not possible. Oil-plants are supplied by provinces in all directions: by Idu (modern Hit on the Euphrates), by cities in the upper Habur basin, from Assur itself and other central Assyrian cities, and from the Zagros foothills. Nor can we draw any deductions from the list of provinces which contributed no oil-plants, when we consider that some of provinces are not recorded as contributing anything at all. All we can say is that the oil-plant does seem to have been widely distributed across northern Mesopotamia, as it was already in 1800 B.C. (Mari, Tell al Rimah) and in 1400 B.C. (Nuzi).

The text VS 19, 9 This is a list of contributions to the Assyrian army active on the south-eastern border near the River Diyala (although they may actually have been delivered in Kar-Tukulti-Ninurta across the Tigris from Assur; see Freydank 1974, 78ff.). Three persons, perhaps military officials, deliver amounts of six different commodities, including oil-plants. A second part of the text lists five single contributions of oil-plants only. These I have given as one quantity under column 4 below, although in fact most of it (19230 litres) was delivered by one man:

Contribution	No. 1	2	3	4	Total
corn (*še'um*)	[15,3]40	8,418	2,890	-	26,658 litres
wheat (**gig.meš**)	[9]50	1,445	2,888	-	5,283 litres
groats (*hašlātu*)	[1]75	110	75	-	360 litres
kurmiššu	[7]83	655	1,408	-	2,846 litres
kudimmu	[4]27	479	558	-	1,464 litres
oil-plant	[2,5]00	800	180	20,940	24,420 litres

That the oil-plant was transported in consignments as large as 19,230 litres confirms its importance in the diet, but it is interesting that as

with the Assur Temple offerings it features mostly in amounts little greater than condiments like *kudimmu* (mustard or cress?[1]) and *kurmiššu* (unknown).[2]

The text VS 19, 33 This is a small administrative note, which comes from the 14th century archive Assur 14446. The broken second half deals with different kinds of bread, but the first half records two issues of oil-plant:

a) 40 litres to (?: *ša pi-i*, lit. "at the word of") a person who is to produce 8 litres of oil (**i**), presumably from the seeds he has received;

b) 50 litres to an oil-presser (**lú.i.sur** = *ṣāhitu*), to produce four "ziggurrats" of 10 litres each. Evidently these temple-towers were fairly substantial culinary creations, and they can in fact be seen on contemporary cylinder seals, placed as an offering on the altar of a god (Porada 1979, 9 with Fig. 14).

The first of these entries is valuable because it suggests that the oil pressed from the oil-seed came to one-fifth in volume of the original dry product. This is in fact the very ratio attested for Ur III and Old Babylonian texts quoted in this volume by Waetzoldt (p. 81) and Stol (p. 124 note 31). It is probable that this was a convenient figure, and that in fact the oil-pressers would usually recover more than 20% from the seeds.

As for the second entry, clearly the cakes must have included a solid ingredient in addition to the oil. There is no reason to suppose that the oil-pressers acted as ordinary cooks or confectioners (using the unpressed seeds), and so their job here must have been to extract the oil in the first instance. The volume of the cakes, being four-fifths of the original oil-seed, shows that it must have been mixed with something else - nor indeed can one imagine that even the gods would have enjoyed a confection consisting exclusively of an oil-seed! Most probably the solid ingredient was some farinaceous product, but it is also possible that it was partly composed of the "oil-seed residue" (**duh še-giš-i** = *kuspī*; cf. Stol, p.122).

The Neo-Assyrian evidence

As in the 2nd millennium B.C. the only textual evidence for the oil-plant in Neo-Assyrian contexts refers to it as a commodity, not to its cultivation. In a text listing offerings due to the Assur Temple in the reign of Adad-nirari III (810-783 B.C.) we have 40 litres of "de-hulled oil-plants" as well as 4 litres of "de-hulled oil" (*šamnu halṣu*; see Postgate 1969, Nos. 42-44, on pp. 93-94). In other contexts too, both religious and secular, we repeatedly find the oil and the plant together: ADD 1036.v.5-6 has "2,000 litres of oil-plant (and) 140 litres of oil" ("oil" here written as **i.kù** [coll.], which suggests that *ellu* is a serious candidate for the Neo-Assyrian word for oil). This was a list of contributions to the palace. Other probably secular references are from Tell Halaf (north-western Habur basin), where 20 litres of oil (**i**) and a little under

200 litres of oil-plant are stated to be owed in Kalhu and Assur, and fr
Kalhu (Nimrud) itself (12,600 litres of oil-plant and 410 litres of oil).
Even in the banquet stele of Assur-nasir-apli II (ca. 880 B.C.) the oi
plants are followed almost immediately by "300 (bowls?) of oi
(ì+giš.meš).[4]

The curious fact is that they are listed together not merely sometime
but usually: this is in fact a high proportion of all the occurrences
the oil-plants in our texts (exceptions: KAV 197 [Postgate 1974, 363-7]
ABL 638, mentioning 8,000 litres of oil-plant from the Diyala area [cf.
19, 9, above, and Waetzoldt p. 80 for other evidence of oil-plant cultiv
tion in this region]). Moreover, in each case the volume of oil is ve
much less than that of the oil-plants - on two occasions only one-tenth
elsewhere probably more. The ratio is therefore nothing to do with th
amount of oil the relevant amount of the plant would yield, but must simpl
reflect the relative quantities needed by the recipients, and the two co
modities would naturally feature together in the administrative transac
tions since they both derive from the same source.

In a 7th century archive of tablets listing deliveries to the Assu
Temple (once again!), the oil-plant occurs regularly, alongside a wid
variety of other foods. It comes in two forms: as a "plant" (*ziqpu*), b
which I mean an entire single piece of vegetation, or in a type of co
tainer called a *lukannu* or *sulukannu* (it seems impossible to know whethe
the SU sign is syllabic or the leather determinative). Other commoditi
in these texts are supplied in *(su)lukannu*, including *šu'u*, which seem
likely to be a legume. Further, in the Assur-nasir-apli banquet stele, th
king lists "10,000 *šu'u* plants" (*ziqpāni*) immediately before the oil-plant
and since the two species both occur in the same two forms, it is quit
likely that they were of similar habit. Unfortunately, of course, *šu'*
remains unidentified.[5]

This virtually exhausts the Neo-Assyrian evidence. It allows us to sa
that oil-plants were a commodity handled in quite large quantities. The
were used for the production of oil, but the seeds, which are often liste
in the same contexts as the oil, evidently were used extensively as a dr
commodity. It seems as though the whole plant was also transported, but i
is not clear why this should have been. The oil comes in much smalle
quantities than the seed, and is a prized dietary item. In offering list
it tends to be mentioned with items like honey and less common food-plants
Yet it was important enough to figure in a list of the essentials of a goo
life: "corn, silver, oil (ì+giš), wool, salt for your meals and a wick(?)
for your lamps" (Frankena 1954, 8: Col. x.29-34).

NOTES

1 For the Assyrian word *kudimmu* see Stol 1985; *kurmišu* is known to me only here, but Stol kindly refers me to Ú *kur-me-šú* (?) in Köcher, KADP 33:20.

2 For the use of sesame residues for animal and human consumption, cf. Weiss 1983.

3 See Weidner, *Die Inschriften vom Tell Halaf* (AfO Beiheft 6), No. 14, and Postgate, CTN 2, No. 138.

4 The Assur-nasir-apli Banquet Stele is published by D.J. Wiseman in *Iraq* 14 (1952), and a new translation given in A.K. Grayson, *Assyrian Royal Inscriptions*, Vol. 2.

5 The Assyrian word *ziqpu* used here is translated by von Soden, AHw 1531a as a carrying-pole ("Transportstange"), but this hardly carries conviction - locusts are carried on poles in the reliefs! I would prefer to take it as the word which clearly applies to young trees in contemporary Assyrian texts (AHw ziqpu 1), and assume that *šu'u* and *šamaššammē* were somehow usable in the form of whole plants. For the Assur Temple texts see G. van Driel, *The Cult of Aššur*.

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THE AGRONOMY, PRODUCTION AND UTILIZATION OF SESAME AND LINSEED IN THE GRAECO-ROMAN WORLD

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The problem of explaining the absence of a specific type of evidence from the historical record is always difficult. There may be a number of forces at work which would militate against the inclusion or preservation of some types of materials. In the case of the preservation and recovery of floral remains from archaeological excavations, biasing factors may be operative before the material is deposited, during the process of deposition, after it has been deposited, and during the process of recovery.[1] In order to determine why linseed is present in the archaeological record from the Near East and sesame seeds are not it is necessary to examine how each of them was treated at the different stages in the formation of the recoverable archaeological record. This paper will examine pre-depositional processes which may have affected the probability of preservation by analysing the evidence contained in agronomical treatises on the production and utilization of sesame and linseed in the Graeco-Roman world.

1. Sesame

There are only four authors who discuss sesame in any detail: Theophrastos, Pliny, Columella and Galen.[2] The word used in Greek is σησαμη and in Latin either *sesame* or *sesima*. The latter would seem to be derived from the former, which in turn, seems likely to be related to the *sa-sa-ma* referred to in the Linear B documents.[3]

Theophrastos categorises sesame as one of the main summer crops along with millet (κέγχρος) and panic (ἔλυμος). They are well-suited to summer conditions, requiring little moisture and having a short growing season. In some places they are irrigated. Sesame was like the lupine in that even animals would not eat it green.[4] Pliny's discussion owes a lot to Theophrastos and so there is much repetition. He does, however, add the interesting tidbit that originally sesame came from India where it was grown for the production of oil.[5] Columella provides the best account of the agronomy of sesame. In Italy, he recommends that it be sown between the autumnal equinox and the beginning of October on a loam if possible, although it is not a particularly fussy plant. He advises an early sowing on wet soils and a late one if the soil tends to be dry. The season of sowing could vary with the environment: "But *I have seen* the same seeds sown in the months of June and July in districts of Syria and Cilicia and harvested in autumn when they are ripe."[6] He recommends a sowing rate of 60-90 kg/ha as optimal and states that each hectare requires 60 man-hours of labour: 12 ploughing, 16 harrowing, 16 hoeing, 8 on the second ploughing and 8 harvesting. These should be taken as maximum figures: most farmers were not as conscientious as the diligent Columella.[7] The description of the plant called sesame by the ancients tallies well with the crop called sesame today, and would, thus, appear to be the same plant.

In the Graeco-Roman world, sesame was used almost exclusively as a foodstuff. Of all the references to sesame oil in the ancient sources, only two did not come from Egyptian papyri or refer to Egypt. Strabo states that the people of Nabatea in Asia used sesame oil because they did not grow olives.[8] The troops under Xenophon in Anatolia covered themselves in a mixture of pig fat, sesame oil and almond oil as protection against a snowstorm because they could not obtain any olive oil.[9] Sesame oil was not an important commodity. But the seeds were eaten by humans. Because it occupied a different ecological niche and was harvested later than the main cereal crops, sesame could be used as a famine food to off-set fluctuations in the yield of wheat and barley, but its main role would have been as a supplement to the diet. The most common sesame dish was boiled seeds mixed with honey and spread on bread; indeed, this was the traditional wedding food in Fifth century BC Athens.[10] The gastronome and nutritionist Galen was not keen on sesame, arguing that it filled up the stomach too quickly, could cause nausea, was digested slowly, and ". . . gives the body a slippery kind of nourishment."[11] Nonetheless, it appears to have been common. Inscriptions from Athens refer to sesame-sellers.[12] Perhaps the sesame/honey mix was one of the street foods of antiquity, a forerunner of the semolina filled μβούγατσα of today.

How the seeds were prepared for human consumption provides a valuable clue as to the potential for seeds to be incorporated into the archaeological record. The most explicit description is given by Pliny. The gathered seeds were first soaked in a tub of hot water. After a while they would be spread out in the sun to dry. When thoroughly dry, the seeds were rubbed. A second soaking, this time in cold water, separated the chaff from the seeds; the former was collected and used as fodder for cattle. The seeds were then spread out to dry in the sun once again. When dry, they were ready either to be boiled or to be ground for human consumption.[13] The important point to note is that sesame can be made edible merely by being immersed repeatedly in water.

2. *Flax/linseed*

In both Greek and Latin, the same word is used for both the flax plant and for linen - and its various derivative products such as fish nets and lamp wicks.[14] In Latin only one word was used: *linus*, whereas in Greek there were two. The most common word used was λινόν. Another, βυσσός, seems to refer only to linen from the region of Elis in Greece. It seems to be different from λινόν but it is not clear how: "The land of Elis is exceedingly fertile and is especially well-suited to the growing of as well as λινόν and κανναβίς."[15] Pliny states that the βυσσός linen from Elis could cost as much by weight as gold.[16] It seems to be qualitatively different from regular linen but in any case, this seems to refer to the linen rather than to a different plant species.

Today distinct strains of the same species are grown specifically for linseed or for flax linen. Through breeding, a plant with a tall stock and small seeds has been developed for flax production.[17] Whether this was the case in antiquity is uncertain. It was an extremely adaptable plant, being grown in regions as diverse as Gaul, Colchis, North Africa and Egypt, which

was noted for its linen. Columella and Pliny agree that flax requires a good, rich soil and that it should not be planted continuously on the same plot because it is a voracious consumer of soil nutrients. Columella warns that it should only be grown if there is a ready market nearby.[18] In his description of the agronomy of flax, Pliny is terse: plant in spring, harvest in summer. It could also be grown as a winter crop as well. Columella recommends sowing sometime between early October and early December at a rate of 216 kg/ha. If planted as a summer crop, then one should sow around the end of February or early March at a rate of 270 kg/ha. Sowing rates of this magnitude indicate that both Pliny and Columella envisage flax being grown for linen production. Plants in such dense stands would have less branches and there would be more individual stocks. Also because flax is such a poor competitor heavy sowing would reduce the amount of time spent weeding.[19] If the aim was the production of seeds, then sowing rates of between 80-125 kg/ha would be more practical.[20]

The discussions of the use of flax in antiquity make it clear that it was grown primarily for the production of linen. Linseed was consumed, but linseed oil does not seem to have been important. I was able to locate only one reference to it. Theophrastos compared linseed oil to the oil from the Christ's Thorn bush in its essential characteristics.[21] Pliny gives the best description of how linen was produced. The plants would be pulled from the ground, not cut, tied into small bunches. These would be hung upside down in the sun for a number of days. After four or five days, all the seeds would have fallen off into a pile.× The stalks would then be retted and turned into linen.[22] Even if the production of seeds was not the main reason for growing flax, they were certainly a useful byproduct. Like sesame, linseed could act as a famine food or as a regular dietary supplement. Pliny states that the peasants of north Italy often ate a porridge made of ground linseed and the Spartan warriors trapped on the island of Sphakteria during the Peloponnesian War ate ground linseed mixed with honey.[23] Galen provides the most detail: "Linseed is consumed with fish sauce as a main dish and is sometimes mixed with honey and spread on bread, but it is difficult to digest and provides little nourishment. It has some diuretic power which becomes evident when it is eaten after roasting but then it is more coortive. *It is eaten most frequently by peasants who after roasting it mix it with honey.*"[24] Linseed has to be processed before it can be consumed by humans. If merely soaked, then it is poisonous. It can be made safe by cooking, most often this was; most often this was done by roasting the seeds.[25] Linseed was used as a foodstuff but only after careful preparation.

× Sesame not linen! P.160

3. *Conclusion*

The evidence from the Greek and Roman agronomists can provide a possible explanation for the presence of linseed and the absence of sesame from the archaeological record at Near Eastern sites. As Van Zeist argued in the paper he presented at the conference, there are no readily apparent post-depositional factors which would selectively favour the preservation of linseed over sesame seeds. Therefore, the biasing factor is probably pre-depositional and related to the manner in which the plants were pro-

cessed to satisfy human needs. Oil can be extracted from both and, in areas where the olive could not be grown, they provided a viable source of oil. But the crushing of the seeds in order to extract the oil effectively destroys them and ensures their disappearance or disintegration in archaeological deposits. Flax was primarily grown for linen, but even then the sees would be available for human consumption. It is only in the way the seeds are rendered edible that there is a sharp difference between the two. Sesame seeds need only be soaked in water and then they are ready to be ground or boiled. None of these processes are amenable to producing residue easily incorporated and preserved in archaeological deposits. Linseed, on the other hand, is usually roasted, a process which would greatly increase the probability of their being preserved in the archaeological record. Van Zeist stated in his paper that linseed recovered from excavations in the Near East was almost invariably carbonized. The presence of linseed then would be attributable to the fact it was usually roasted; the absence of sesame can be explained not by the argument that it was not grown but by the fact that it was processed in a manner which did not produce remains capable of withstanding the test of time.

NOTES

1. For an excellent discussion of this topic see: G. Jones, "The Ethnoarchaeology of Crop Processing: Seeds of a Middle-Range Methodology," *Archaeological Review from Cambridge*, 2:2 (1983), 17-26.

2. The particular works to be cited throughout are:
Theophrastos, *History of Plants* (hereafter, Theophrastos, *HP*),
Theophrastos, *On the Growth of Plants* (hereafter, Theophrastos, *GP*),
Pliny, *The Natural History* (hereafter, Pliny).
Columella, *On Agriculture* (hereafter, Columella),
Galen, *On Nutrition* (hereafter, Galen).

3. J. Chadwick, *The Mycenaean World* (Cambridge: Cambridge University Press, 1976), 135, 144 and 227. M. G. F. Ventris and J. Chadwick, *Documents in Mycenaean Greek*, ed. J. Chadwick (Cambridge: Cambridge University Press, 1973), 227, 582.

4. Theophrastos, *HP*, 8.1.1, 8.7.3.

5. Pliny, 18.22.

6. Columella, 2.10.18.

7. Columella, 2.12.5.

8. Strabo, *Geography*, 16.4.26.

9. Xenophon, *The Anabasis*, 4.4.13.

10. Aristophanes, *Peace*, 869; *Acharnanians*, 1092; *Thesmophoriazusai*, 570. H. G. Liddell and R. Scott, *A Greek-English Lexicon*, revised by H. S. Jones (Oxford: Clarendon, 1968), 1599.

11. Galen, 1.29.

12. I.G., 2^2.1561.23; 2^2.1554.40.

13. Pliny, 18.23.

14. For a discussion of the use of and terminology pertaining to flax nets, see: T.W. Gallant, *A Fisherman's Tale: An Analysis of the Potential Productivity of Fishing in the Ancient World* (Gent: Miscellanea Graeca, 1985), 3-4.

15. Pausanias, *Travels in Greece*, 6.26.4.

16. Pliny, 19.1.

17. J. A. S. Watson and J. A. Moore, *Agriculture: Its Science and Practice* (London: Macmillan, 1962), 374; I. Arnon, *Crop Production in Dry*

Regions. Volume II: Systematic Treatment of the Principal Crops (London: Leonard Hill, 1972), 381-387, 393-398.

18. Pliny, 19.2; Columella, 2.10.17. See also, Herodotos, *The Histories*, 2.105, 4.74 and Theophrastos, *GP*, 4.5.4.

19. Columella, 2.10.17.

20. Watson and Moore, 374.

21. Theophrastos, *HP*, 3.18.3.

22. Pliny, 19.2.

23. Pliny, 19.2; Thoukydides, *The Peloponnesian War*, 4.26.8.

24. Galen, 1.32.

25. This point is discussed in all the relevant literature; a detailed exposition on it can be found in J. Renfrew's contribution to this volume.

IS ŠE-GIŠ-Ì SESAME OR FLAX?

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The existence and identity of *Sesamum indicum* L. as a Mesopotamian oil source have been controversial since 1966, when H. Helbaek reported that not a single seed of sesame had been found in the Near East from earlier than Islamic times. The Chicago Assyrian Dictionary and some other cuneiformists subsequently have translated **ŠE-GIŠ-Ì** as 'linseed'. Helbaek's assertion that no ancient sesame remains have been excavated is inaccurate, but the reported finds from the Near East are late. Sesame was a major item of agriculture in the Iron Age Urartian economy, and that kingdom was a northern neighbor of Mesopotamia.

Many earlier Sumerian references to an oilseed, **ŠE-GIŠ-Ì**, are found in cuneiform texts concerning oil rations, ritual offerings and loans for stock seed, from about 2300 B.C. (Jacobsen, 1958). Written evidence is admittedly weaker than actual seed remains for positive establishment of crop occurrence, but in the absence of seed remains we are forced to rely on literary and linguistic data. This paper reviews and evaluates those data. A longer article presents evidence for cultivation of sesame throughout the ancient world (Bedigian and Harlan, 1985).

BOTANICAL TRAITS AND SEASONAL REQUIREMENTS OF SESAME AND FLAX

Sesame can be distinguished from other oilseeds, such as flax, mustard, rape or radish, that may have been grown in ancient Mesopotamia. One important distinction is sesame's growing season. It is a warm-season crop, and must be planted after any danger of frost is past; it adapts well to high temperature and drought stress, but it cannot tolerate waterlogged soil. Cultivars show a wide range of variation in date of maturity: some can be harvested after 70 days; others require 180 days to mature (Bedigian and Harlan, 1983). The crop can grow in a variety of soil types, with cultivars that are specially adapted to each. Sesame is not demanding in nutrient requirements and can follow more soil-exhaustive crops. Sesame seeds sprout readily, without special treatment to remove germination inhibitors.

Seed color varies from white to black, with intermediates ranging from ivory, beige, tan and olive green, to brick red, brown, and charcoal grey. The seed surface usually looks granular when viewed with a hand lens. Seeds are generally 2.5 to 3.5 mm long. The placental attachment (hilum) of the seed looks round, viewed end-on, but the seed's flat sides and raised margin give it a rectangular appearance.

Seeds of sesame contain the lignans sesamin and sesamolin. A special property of sesame oil is its stability against rancidity, due to the presence of these natural antioxidants, that are not found in other edible

oils (Bedigian, Seigler and Harlan, 1984). These compounds are also insecticides and powerful insecticidal synergists. Sesame oil is regarded gastronomically and chemically, as a superior quality oil (Levey, 1959). Sesame seeds yield 50 to 60% oil in modern processing methods (Weiss 1971).

An ancient method of crushing sesame seeds for oil extraction is given in *Law's Grocer's Manual* (*circa* 1892): "Sesame is also widely cultivated in Syria, where, in preparing the oil, the grain is soaked in water for 2 hrs, and then placed in an oblong pot, coated with cement, on which two men work a wooden hammer of 20 lb. weight . . . Efforts are not made to mash the kernels. The skins are separated in a tub of water, salted to a degree sufficient to float an egg. The bran sinks, while the kernels remain on the surface. The sesame seeds are now broiled in an oven, and sent to the mill to be ground. From the millstone the oil drops into a jar, and is thick, of a dark yellow colour, and sweet."

Sesame leaves exude a mucilaginous substance when injured (Levey, 1959; DB, pers. observ.). Many herbarium sheet labels indicate that sesame leaves are used for soap or shampoo (DB, unpubl. data).

Sesame fruits are capsules that vary in size from 1.5 to 4 cm, depending on the cultivar. The plant's indeterminate growth allows capsules to be initiated continuously throughout the season. Sesame capsules release their seeds easily when they dry, and will spill them on the ground if the branches are not harvested in time. Therefore, sesame branches are cut while still green, and sun-dried; a few weeks later the bundles of branches are inverted and shaken onto sheets to collect the seeds. Sesame's easy-bursting (dehiscent) capsule may have inspired the "Open, Sesame" incantation in "Ali Baba and the Forty Thieves."

Flax can be distinguished from sesame by its seasonal requirements. Flax thrives in moderately cool temperatures (Veerhoff, 1940; Martin, Leonard and Stamp, 1976), and is grown as a winter annual in warm climates. Linseed is cultivated where the annual range of precipitation is from 450 to 750 mm, or under irrigation in dry climates. Drought and high temperature (35°C) during and following the flowering stage reduce the yield and affect oil quality. Cool weather during the early stage, followed by warm, dry weather, provides excellent conditions for fiber-flax production. Flax grows best on well-drained, medium-heavy soils, especially silt loams, clay loams and silty clays. Light soils are unsuited to seed flax, particularly in regions of deficient rainfall (Martin, Leonard and Stamp, 1976).

The cultivars of flax grown for fiber have long stems with relatively few branches, while cultivars grown for oilseed have shorter and many more branches and produce a greater quantity of seed (Eckey, 1954). The fruits of flax are indehiscent or semi-dehiscent spherical capsules that terminate a branch. Traditionally, in regions without mechanization, flax is harvested by pulling the plant up by the roots (nasāhu) and moving it to the threshing floor, where the seeds are beaten out.

Flax seeds are yellow, olive green, tan and brown, and are 3 to 6 mm in length. They are flattened and have no raised margin. The surface appears

smooth and shiny because of its mucilaginous coating. The apical hook is a curve at the narrow end of the seed. This curve is very pronounced on flax seeds, though sesame seeds are occasionally curved at the apex. Oil flax contains 32 to 42% oil.

Linseed oil has a high degree of unsaturation, so that it reacts readily with oxygen. The products formed from this reaction make linseed oil highly useful in the manufacture of paints, and as a standard drying oil (Eckey, 1954), but as a food oil, the high rate of oxidation allows rapid spoilage with development of objectionable rancid odor.

The earliest archaeological flax remains discovered are reported from Çayönü in Turkey, and from the Bus Mordeh phase at Tepe Ali Kosh in Iran, both before 6000 B.C. (Helbaek, 1969; Van Zeist and Bakker-Heeres, 1975). Seed size (3.5 to 6 mm) indicates that these were domesticated.

Seed oils of several species of Brassicaceae may have been used in Mesopotamia. They too are cool season crops. The fruits are siliques, and are much smaller than sesame capsules. The round seeds are 1 to 2 mm in diameter, and seed color may be white, red, purple, brown or black. The seed surface is marked with hemispherical contours. The seeds yield approximately 40% oil (Eckey, 1954; Martin, Leonard and Stamp, 1976).

Remains of charred seeds of *Brassica* sp. (mustard) or *Sinapis* sp. (radish) were found in room 046:1 and especially in "House D" in rooms K43:3 and 5, and L43:7, 9 and 10, from the Temple Oval at Khafajah, ca. 3000 B.C. (Delougaz, 1940). They are in the collection at the Oriental Institute, University of Chicago, but seed preservation is inadequate for more specific identification. Prof. E. Schiemann of the Botanical Museum, Berlin, was able to identify some of these in room L43:10 as belonging to a crucifer, *Brassica* or *Sinapis*, "the oil of which could be used either in cooking or as fuel for lamps."

ANCIENT INDIA

The origins of the Indus Valley civilization are not yet understood, although it must owe something both to the Iranian settlements and to influences from Mesopotamia (Hawkes, 1976). Mature by 2500 B.C., it was at its height at the same time as Sargon's empire (2372-2316; successors to 2230) and 5th dynasty Egypt (ca. 2494-2345), but was declining early in the 2nd millennium. It flourished over a wider area than these two other great ancient civilizations, with an economy based on wheat and barley cultivated by irrigation.

Sesame seed remains were found at the Indus Valley civilization site of Harappa (Vats, 1940), where excavators uncovered "a quantity of lumped and burnt sesamum" specimens. Sesame was found in mound F, trench IV, stratum v, with burnt grains of wheat and peas, in the hollow of circular platform P8. A number of broken jars and an underground drain were also excavated at that level, at a depth of 2 m, in square L 12/4. "A rectangular platform with a mud core which is secured on all sides [is] surrounded by

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brick-on-edge laid lengthwise. This unsubstantial construction was probably due to the necessity of economising bricks" (Vats, 1940). The mortar was mud but the pointing was gypsum. The purpose of the platform is not clear. Vats reports that from stratum iv down, the Harappan site pre-dates Mohenjo-Daro, and he attributes the sesame to ca. 3050-3500 B.C. Harappa is the only site in India or Pakistan where sesame has been found (Vishnu-Mittre, 1977).

INDIAN ORIGIN OF SESAME AND ITS ETHNOBOTANY

Genetic, morphological and phytochemical evidence support the hypothesis that domesticated sesame originated on the Indian subcontinent (Bedigian, Seigler and Harlan, 1984; Bedigian, Smyth and Harlan, 1984). Archaeological evidence just mentioned substantiates claims that sesame cultivation began in India. The crop progenitor that we have proposed, described as *Sesamum orientale* var. *malabaricum* Nar. (John, Narayana and Seshadri, 1950), still occurs wild today in gravelly crevices of granitic rock outcrops, and is weedy in many parts of India. We collected seed of the progenitor from northern India (Delhi Ridge) to 78° E longtitude. It grows wild at the Walayar Forest Reserve (Tamil-Nadu) and was seen weedy along the railroad line from Delhi to Trivandrum. It is a weed in formerly cultivated land as well as along the roadsides.

Hortus Malabaricus, a 12 volume *magnum opus* on the plant wealth of Malabar is a landmark contribution on the rich medicinal plant resources of the region. It is the oldest publication on Indian plants in any European language (Manilal, Suresh and Sivarajan, 1977). Hendrik van Rheede, a governor of Cochin (1663-1677), here published information from his journals about native and traditional Brahmin medicinal plant resources. Three Brahmin priest-physicians dictated the names and medicinal properties of plants listed in their authority, the *Manhaningattnam*, a text that has never been found, and that may never have been written down. Thus van Rheede preserved valuable ethnobotanical information about local plants, accumulated over hundreds of years. His work is unsurpassed even today (Manilal, 1980).

Van Rheede's observations are accurate morphological descriptions and the accompanying sketches provide unmistakable confirmation of his identifications. Linnaeus and other botanists made use of the figures and descriptions in this work as "type specimens" for establishing new genera and species (Manilal, Suresh and Sivarajan, 1977). The wild progenitor of sesame that we have proposed (Bedigian, Seigler and Harlan, 1984; Bedigian, Smyth and Harlan, 1984) is one example of this typification. Concerning sesame, van Rheede said (1689): "there are two species of *Elu, Schit-Elu* and *Car-Elu*; the first is called *Davo-Tiloe* by the Brahmans . . . Oil is extracted from the seeds, for the benefit of nearly whomever is presented with pains, and the indigenous people use it in a washing solution most regularly, for anointing the body and often as any are troubled by aches."

The second *Elu, Car-Elu* (*Caro-Tilu* in Sanskrit) could be the wild sesame variety called *jartila* in Sanskrit (Kuiper, 1955) today. Concerning

it, Rheede says the following: "*Car-Elu* is the second species of sesame; not noted by anyone before, so far as I know. Thus it can be named Sesamum indicum "of wide, serrate leaves, large(r) flower and blackish seed. The Malabar people call it *Bidzjam Hitem*, for the color of the seed. It is mostly the same as the first species, only it grows a little taller. Likewise, its stalks are somewhat thicker, and the leaves, flowers and seeds are bigger. The color is darker, and the juice is rather bitter. The flowers when eaten alleviate complaints of the eyes; when ground together with fruits and made with butter into plasters, they bring abcesses to ripeness. The oil extracted from the seeds (it goes by the name Sirgelim Oil) relieves the wind of persons of phlegmatic humor, when liberally smeared on the body. If the Malabar people are to be believed, the oil makes fat people thin and lean people plump, dispels cataracts, and strengthens weak vision (when spread thick on the head). From the same oil are prepared ointments for wounds and ulcers -- like Amphion, the oil takes death upon itself. The ground seed, taken with cayenne juice, dispels dizziness. Well washed and decorticated, the seeds are preserved in several ways."

A list of local names for sesame in India reveals widespread adoption of the word *ellu* or its derivatives: Assam, Bengal, Maharashtra, Punjab, Uttar Pradesh and the Sanskrit, Hindi and Urdu languages use *til*; Gujarat uses *tal*; Kerala and Tamil-Nadu use *ellu*; Karnataka uses *yellu*; Andhra Pradesh uses *nuvvu-lu*; and Bihar and Orissa use *gingil* (Kirtikar, Basu and An, 1918; Sampson, 1936; Indian Agricultural Research Institute, 1961).

The earliest form of the Dravidian word for sesame would be *eL* (that is, *e* plus a retroflex *l* with an alternative pronunciation *eLLu*, the doubling of the consonant and addition of final *u* being a normal alternant in the oldest Dravidian (F. C. Southworth, South Asia Regional Studies, Univ. Pennsylvania, pers. comm.). The appearance of *ellu*, in a non-Aryan language (Kuiper, 1955; Masica, 1978), suggests an ancient source for the word. Although the original language of Harappa is unknown, Fairservis (1983) considers Dravidian to be a likely source. Other scholars favor a link to Indo-Aryan or Munda languages (H. Hock, Assoc. Prof. Linguistics, Univ. Illinois, pers. comm.). There may never be a way to validate these hypotheses.

Parallel linguistic evidence from ancient India suggests that sesame (Sanskrit *tila*) may have been the oilseed *par excellence*. Literally *taila* (nominative *tailam*) means 'oil made from sesamum seed' (F. J. B. Kuiper, pers. comm.). Burrow (1947) suggested that the Dravidian word is the source of the Sanskrit word. Though this may never be proven, *taila* is clearly a loanword in Sanskrit (C. P. Masica, Assoc. Prof. South Asia Area Language Center, Univ. Chicago, pers. comm.) and in time *taila* became the general term for oil that has remained in use to the present day (Dymock, Warden and Hooper, 1893; Prakash, 1961; Monier-Williams, 1964; Nayar & Mehra, 1970). The Sanskrit words *tila*, *jartila*, *tilpinja*, and *tilapinji*, all occur in old Vedic texts. The Vedic scriptures (ca. 1000 B.C., no exact date can be given) contain instructions for using sesame seeds in a ceremonial food symbolic of immortality (Dymock, Warden and Hooper, 1893). According to the *Brahmapurana*, *tila* was created by Yama, the king of death, after prolonged penance. A Buddhist text, the Grihyasutra of Asvalayana,

directs that in funeral ceremonies sesame seeds be placed in three sacrificial vessels containing sacred Kusa grass (*Desmostachya bipinnata* Stapf, S. & B.) and holy water with the following prayer: "Oh Tila, sacred to Soma, created by the gods during the Gosava (the cow sacrifice, not now permitted), used by the ancients in sacrifice, gladden the dead, these worlds and us!" Sesame seeds with rice and honey are used to prepare the funeral cakes called *Pindas*, that are offered to the ancestors in the Sraddh ceremony by the Sapindas, or relations of the deceased (Dymock, Warden and Hooper, 1893). *Tilanna*, sesame-rice balls formed in the shape of cows, are offered to relatives and friends of the deceased after the funeral. This ritual is enacted to say a proper 'farewell' to the departed. The offering of sesame seeds is considered effective in removing sins (Gupta, 1971). The word *tilanjali* is a derived word that means 'to bid a final goodbye/ to leave' (Hindi-English Dictionary, 1970).

On certain festivals six acts are performed with sesame seeds, as an "expiatory ceremony of great efficacy by which Hindus hope to be freed from sin, poverty and other evils, and secure a place in Indra's heaven" (Dymock, Warden and Hooper, 1893). These acts are *tilodvarti*, 'bathing in water containing the seeds'; *tilasuayi*, 'anointing the body with the pounded seeds'; *tilahomi*, 'making a burnt offering of the seeds'; *tilaprada*, 'offering the seeds to the dead'; *tilabhuj*, 'eating the seeds'; and *tilavapi*, 'throwing out the seeds'. In proverbial language a grain of sesame signifies the least quantity of anything, e.g. *til chor so bajjar chor*, 'who steals a grain will steal a sack'; *til til ka hisab*, 'to exact the uttermost farthing' (Dymock, Warden and Hooper, 1893): Mehra (1967) summarizes the recorded uses of sesame in India in historic times.

ANCIENT MESOPOTAMIA

The Sumerian **še-giš-i** refers to an oilseed crop. The identity of this plant is undecided. Various ancient names translated as 'sesame' are **še-giš-i** (Sumerian), *šamaššammū* (Akkadian), *šumišumi* (Hurrian), *ssmn* (Ugaritic), *sasama* (Mycenaean Greek), *sapsama* (Hittite), *su(m)sem(in)* (Aramaic) and *simsim* (Arabic) (Hoffner, 1974). It is likely that **še-giš-i** referred to sesame since the introduction of the plant. On the other hand, the word **še-giš-i** could have applied to whatever crop was used for oil, initially, and later, when sesame was introduced, the name became affiliated with the sesame crop. It could reflect an adaptation of olive, the earlier oil source, so as to distinguish it as the grain-like substitute of olive.

The date of introduction of sesame to Mesopotamia from India cannot be determined; we only know the oldest, presently available attestations, since ca. 2400 B.C. It is known that there were trade contacts between the Indus valley and Mesopotamia as early as the 3rd millennium, B.C. (Hornell, 1941; Wheeler, 1968; Gelb, 1970; Dales, 1971; Lamberg-Karlovsky, 1972). The earliest mention of **še-giš-i** in texts occurs just after the middle of the 3rd millennium (Jacobsen, 1958). It is a convenient hypothesis that sesame was cultivated widely in Sumer/Akkad from that time, and that such cultivation was stimulated from contacts with NW India.

Early Old Babylonian (OB) documents contain numerous references to "**i-giš** = *ullu/ellu*, the ubiquitous sesame oil" (Simmons, 1978). Texts list the expenditure of sesame oil "for the inner bolt," "for the fire offering," "for the prince," "for the royal purification rite," "for the inner bolt on the day of Akitu," "for the sizkur DN," for the Elunum DN," "for the regular offering," and "for anointing the banner." These are all special cultic applications, uses of oil to lubricate, soap or fuel someone or something, almost certainly at springtime festivals (W. Doyle, Instructor of Mesopotamian Civilization, Harvard University Extension, pers. comm.). Von Soden, (1961), indicates that *ellu* is 'good' sesame oil (**i-giš** = *ellu*).

The Akkadian word *ellu*, meaning both 'pure' and 'sesame oil' is intriguing because of its resemblance to the early Indian word. The Akkadian *ellu* contains two homonyms: *ellu* the adjective means 'pure' or 'bright'; the noun, possibly a loanword from Dravidian, means 'sesame oil'. Within the Akkadian context, *ellu* meaning, 'pure' is never found in correspondence with Sumerian **-kù-**, 'pure', suggesting that it is a loan word (W. Doyle, pers. comm.).

The Assyrian Dictionary (CAD, 1958) article for *ellu* gives definition 2. holy, sacred; 1.2', "clean, pure in connection with oil, etc., . . . fine oil . . . sweet oil . . . pure sesame oil, sesame oil of the first (pressing)" (Thompson, 1903), used for anointing and making perfume. Its *ellu* B article discusses sesame oil of a specific quality: *ellu* (in contrast to *hilṣu*, 'refined oil') refers to a standard quality of sesame oil (Hilprecht, unpubl. OB tablet). Two products are extracted (*ṣahātu*) from sesame: "*hilṣu* oil [should amount to] one-third of the *ellu* oil" (Pinches, 1899, cited in CAD, 1962). The varieties of oil discussed by Goetze (1956) establish the value of **i-giš** at 30 times the value of **še**, barley.

Records from Mesopotamia contain frequent references to the oilseed **še-giš-i**. Interpretation of these texts to establish the botanical identification of the oilseed requires many inferences, in the present state of research on the records. One way to distinguish sesame from other oilseeds that could have been grown in the region relies on the seasonal requirements of each. Other oilseeds including flax, mustard, rape and radish, unlike sesame, are cool-season crops and should be grown during the winter in Mesopotamia (see BOTANICAL TRAITS section). In Mesopotamia, sesame was handled as an off-season crop by the barley industry in the manner that it was irrigated, plowed and reaped (W. Doyle, pers. comm.).

Clarification of planting dates of the oilseed **še-giš-i** can be useful to ascertain whether the crop is more likely to be sesame or another oilseed. Establishment of a spring planting date would be strong evidence in support of sesame as the oilseed **še-giš-i**. A coherent pattern of field rentals for sesame growing, loans of sesame seeds for planting, and deadlines for payments, would help strengthen the assertion.

Land rental contracts can help elucidate the crops grown. Legal and administrative texts of the reign of Samsuiluna [1749-1712] (Feigin, 1979) offer the following records of transactions involving the **še-giš-i** crop, that Feigin translated as sesame:

YOS12	YBC	Yr	Mo	Da	Text
147	3332	6	3	10	Rent of field to grow sesame
215	6069	7	2	10	Rent of field to grow barley and sesame
220	6039	7	3	25	Sub-rent of field to grow barley and sesame
298	5945	8	4	?	Rent of field to grow sesame
300	6083	6	6	?	Rent of 2 types of fields to plant barley and sesame
490	6073	27	2	20	Rent of **ab.sín** field to grow sesame
492	5907	27	3	?	Rent of field to grow sesame
502	5986	28	1	1	Rent of field to 2 tenants to grow sesame

A list of dated texts concerned with rentals of fields for the cultiva-tion of sesame (Stol, 1984) show the greatest number from the months 2, 3 and 4, but tells nothing about field-sizes, rents, or give-back dates.

Other records that might offer evidence of planting dates to identify the crop **še-giš-î** are loan records. Some examples can be found in Finkelstein 1972.

YOS13	Tablet #	Mo	Da	Text
22	MLC 1519	4	24	Loan of silver to purchase sesame, to be repaid in sesame
307	MLC 1381	4	3	Sesame for seeding
391	YBC 8722	5	1	Sesame for seeding
464	YBC 3323	5	4	Sesame for seeding
528	MLC 1727	4	10	Joint tenancy field lease for growing sesame

Mesopotamian sesame was grown as a field crop, while flax was a garden crop, grown in small plots, on enriched soil. A letter from Nuzi (CAD, 1959) exhorts the recipient to "plant *šamaššammū* and millet! (*šamaššammū u du-uh-na eriš*). Since millet, be it *Setaria*, *Panicum*, *Pennisetum* or even *Sorghum*, is summer-grown, it is reasonable to conclude that *šamaššammū* is a summer crop. The date of this text is ca. 1550 B.C. Herodotus, too, associates the summer planting of millet with sesame: "In winter, indeed, they have rain from heaven like the rest of the world, but in summer after sowing their millet and their sesame, they always stood in need of water from the river" (III.117).

Other circumstantial evidence about sesame's growing season can be gathered from an OB letter, suggesting that sesame was still growing after the barley harvest in March-April. The text suggests annual alternation of the barley fields with sesame. A letter (BM 17379) requests the recipient to "Inform me about all fields which have been worked [tilled, but not planted] until now and about the [growing] sesame field" (Kraus, 1964). This letter indicates that it was off-season for planting barley, and that the majority of the fields were idle. The barley harvest in Mesopotamia

occurred in the spring. Then barley fields could have been rotated with summer-sown sesame.

According to Landsberger (1949), the spring equinox (March 15 to April 1) was the time of cutting the early barley; this activity continued through May. June was the time of field preparation for planting [the summer crop]; July was the month of Tammuz, the time of storage of barley, characterized by the ritual festival celebrating the sealing of the granary, i.e. the end of the barley harvest. The principal use of irrigation water was in the autumn, to soak the fields before planting grain; after germination, they tried to rely on rain.

The *šamaššammū* article prepared for CAD, volume "Š" (galley proofs of the manuscript, p. 510-520), mentions several texts that help to identify *šamaššammū* as sesame. An OB text concerned with processing the seed (1'c) says: "it came to 90 gur of *šamaššammū*, before it started raining. I managed to crush 40 gur of it and the rain did not arrive to ruin it" (Dossin, 1933). The rains begin in October/November in Mesopotamia, thus the text refers to a summer crop that was harvested in the fall.

Šamaššammū is assigned to the constellation Taurus (Weidner, 1967, cited in CAD, *s.v.* 4'h p.519) and that is likely to indicate planting time (H. Waetzoldt, pers. comm.). An OB letter instructing a farmer not to soak [irrigate] **še-giš-î** before the appearance of Sirius (Frankena, 1968) supports a summer planting of the crop, because Sirius rose ca. June 22 (see DISCUSSION section). There is support for these suggestions of astronomical controls of agronomic practice in Mesopotamia, from nature, because the belt stars of the constellation Orion (the hunter), battling Taurus (the bull), point toward Sirius, the brightest star in the sky (Menzel, 1964). The vernal equinox was in Taurus at 2000 B.C. and would have been seen about March 21. The sun would have been in Taurus on the first day of Spring (March 21) and Taurus rising would have occurred in mid-April.

The CAD article about *šamaššammū* contains many references to oil pressing, including one text (Keiser, 1917; Clay, 1919 [both NB let.]) cited in CAD *s.v.* 2' p. 516)] that specifies *šamaššāmmu peṣūtu* (white *šamaššammū*). The texts concerning white-seeded *šamaššammū* are arguments of considerable importance in helping to distinguish flax from sesame because there are no flax cultivars with white seeds (J. Miller, Dept. of Agronomy, North Dakota State Univ., who maintains the USDA's world collection of flax germplasm, pers. comm.).

The CAD review contains other references to **še-giš-î** as food for the royal meal, as a medicine and for making soap, with alkali and juniper resin.

Stol (1984) indicates a textual reference to 'sweet', *matqūtum*, sesame, that reminds us of the folk classification by Sudanese farmers. Sesame used for its seeds were called 'sweet', while sesame grown for its oil was considered to be 'bitter' (Bedigian and Harlan, 1983). Often, the red-seeded sesame cultivars had the highest oil content, but the testae probably contained high levels of tannins or other bitter-tasting constituents. The 'sweet' sesame was white-seeded.

A fragment of a Neo-Assyrian textbook tablet concerns the problem of ants in a storage bin with *šamaššammū*: "If ants are seen in a man's house (*ina i.* É.DUB *šamaššammī*), in the storage bin for *šamaššammū*," followed by a break (Ebeling, 1923 [SB Alu] cited in CAD *s.v.* p. 514). This may be strictly coincidental, but it might have considerable significance, in view of the role of the lignans of sesame as insecticides (DISCUSSION section, this paper; see also Bedigian, Seigler and Harlan, 1984).

Waetzoldt (1983; 1984) indicates that the context of *šamaššammū* in third millennium texts much more strongly suggests the superior quality of sesame oil than the utilitarian quality of linseed. "Large quantities of the oil are used for nutrition, and for offerings, therefore we assume that it can be considered a good edible oil." It was used in temple offerings and for royal feasts. Waetzoldt agrees that flax is cultivated in the winter, while **giš-î** is cultivated in the summer. Flax farmers are called **engar-gu**, while sesame farmers are called **engar-giš-î.**

"The thing that strikes me most about sesame in Mesopotamia is that the plant had no proper name, only '(the) oil plant' in both Sumerian and Akkadian, and that this compound term was universally adopted in points west. This shows that the plant was not known by any name before it was received by the Sumerians, in Mesopotamia, and the Sumerian-Akkadian equivalence of terms makes it not unlikely that speakers of both languages encountered it at about the same time" (W. Doyle, pers. comm.). Further support for sesame as the original oil crop is the fact that the universal word for oil, *taila*, in India, is derived from *tila* (see INDIAN ORIGIN OF SESAME AND ITS ETHNOBOTANY, above). Even in Swahili, the word *ufuta* means both oil and sesame (A. Scheven, Dept. of Linguistics, Univ. Illinois, pers. comm.). Further details concerning the relationship of sesame to the etymology of the word 'oil' will appear in a forthcoming publication.

URARTU: THE KINGDOM OF VAN

The kingdom of Urartu, a northern neighbor of Mesopotamia, presents evidence that is highly indicative of Assyrian practice. Sesame is known to have been grown intensively during the Iron Age on the plateau of Urartu (Ararat), ancient Armenia (900 to 600 B.C.); the Urartians processed the seeds for oil (Kassabian, 1957; Piotrovskii, 1950; 1952).

The Urartian empire is known for its innovations in engineering works. Extensive aqueducts, irrigation canals and channels carried snow meltwater from the mountains to fields in the valleys by an intricate network. This fact, along with the plant remains of cereals and fruits, suggests that agriculture, arboriculture and viticulture were highly developed there by the Iron Age (Kassabian, 1957).

In the 7th c. B.C. the Urartian city of Teishebaini (Karmir Blur) was a processing center for vegetable oil. Sesame seeds were excavated at Teishebaini, (Armenian, Karmir Blur), on the outskirts of present-day Yerevan. The site's ancient name is in honor of Teisheba, god of war and

of storm, one of the three major deities of the Urartian pantheon. Karmir Blur was an important administrative and economic center of the state of Urartu, that flourished from the 9th c. until its destruction by invading Scythians and the Median invasion in 585 B.C. Teishebaini's primary function was as a storehouse and processing center of agricultural produce, as well as a regional citadel or fortress. The size of the citadel reflects bulk storage of crops. Excavations reveal an oil press workroom, 30.9 m long and 3.9 m wide [Room 2 of their plan]. Stone mortars and pestles were found on the north side of the room. The workroom's east and south corners each held a basin-shaped stone container, 79 cm in diameter, carved from a block of tufa. The basin joined a cylindrical pipe made of the same stone, that allowed waste liquid to drain out beyond the citadel. It seems reasonable to assume (with Piotrovskii, 1950) that the basin or tub was used to moisten the sesame seeds before working them. Sesame seeds brought to the oil press were first washed in the basin to remove dust and soil, then soaked to ease the removal of the tegument. Stone mortars, pestles and graters were found that were used to remove the seed coats after the seeds had been soaked and dried.

The workrooms were furnished with fireplaces for parching the seed. Conical basalt rocks were used for the final pressing of the oil, expressed from a thick, viscous residue of sesame paste that was previously poured into baskets and macerated coarsely. The abundance of pressed cake residues, and the size of the stone vat suggest the large quantity of sesame oil processed at Teishebaini.

A wooden press for squeezing the oil must have been burned during the fire that destroyed the citadel, and has left no trace (Piotrovskii, 1966). Both the area where the casks of sesame oil were stored and the pressroom bear marks of a fire, during which the clay bricks of the wall not only acquired a red color, but were also partly fused (Piotrovskii, 1966).

Three areas of the citadel, on the northwest (N. 1-3) were devoted to the preparation of sesame oil. Large (ca. 1.5 m tall) clay storage jars were found in storerooms of a workshop consisting of over 150 rooms on the ground floor, where wine, beer and sesame oil were processed (Piotrovskii, 1950; 1952). Stores of sesame were found in four huge clay jars, placed together in a small pit (N. 7) on the north side of the citadel (Piotrovskii, 1966). Cakes of pressed sesame, the solid residue that remains after seeds are crushed for oil, were also uncovered.

The only Urartian plant remains identified to date have been found at Karmir Blur. Plant remains indicate that the principal cereals cultivated were barley and both einkorn and emmer wheat. Remains of rye and millet also occur. Sesame was also found in mixed stores of grain, among barley and seeds of two legumes: chickpea and lentil. It seems that roasted grains and seeds were thought to be delicacies, as shown by ethnographic parallels (Piotrovskii, 1950).

Urartian agriculture illustrates a successful adaptation of a people to a severe environment. The extreme climatic conditions of the Armenian plateau made artificial irrigation a necessity for the development of the intensive agriculture, horticulture and viticulture that resulted from

these efforts (Harutyunian, 1964). Their massive irrigation works and innovative technology permitted the entire landscape to be watered and devoted to crops. Excavations at Toprak-kale, just east of the citadel at Van, have yielded only a few agricultural tools: iron blades of plows or hoes, sickles, pitchforks, and remains of grain (incidentally, unstudied to this day) and fragments of huge storage jars, intended obviously for storage of grain and liquids, on which hieroglyphic and cuneiform marks indicated their capacities (Harutyunian, 1964).

SOUTHERN ARABIA: HAJAR BIN HUMEID

Reconstruction of the agriculture of ancient southern Arabia (5th c. B.C.) was established from seed impressions from within pots that left imprints in the clay vessels. Sesame is included among the list of useful plants identified in this manner (van Beek, 1969).

DISCUSSION

The entire archaeological seed record from Mesopotamia is distressingly small. Sesame seeds might be absent because the collection is not sufficiently large. Sampling for plant remains was never done systematically from a wide variety of site types. Excavators have only recently incorporated the assistance of archaeobotanists or ethnobotanists on their study teams.

The absence of archaeological finds of sesame seeds in Mesopotamia might also be explained by their particular chemical composition and structure that could result in poor preservation. Cereals, such as wheat and barley, and flax, may retain their form upon carbonization better than sesame. The results of carbonization of sesame and flax, experimentally, in our laboratory, showed that seeds of sesame were more friable than flax. Carbonized sesame seeds flaked and disintegrated when rubbed between the thumb and the index fingers, whereas carbonized flax seeds remained intact. These experimental differences in preservation might also occur under natural conditions. In support of this hypothesis, it should be noted that the reported remains (Vats, 1940; Piotrovskii, 1950) are found in bulk, and not as single seeds.

We think that the failure to find excavated sesame in ancient Iraq is due to circumstances of excavation: sesame seeds are relatively small and fragile. Sesame (like barley) was a field-crop, probably processed outside the towns for flour or oil. We can assume this since it was delivered to the towns as oil, in the texts. We need not expect to find sesame seed among the finds of town-excavations, any more than we expect to find large deposits of barley-grain, which are also noticeably absent (W. Doyle, pers. comm.).

A fragmentary Akkadian omen text that mentions *šamaššammū* in association with ants in a storage bin [KAR 376 r. 19 (SB Alu) cited in CAD, unpublished manuscript, p. 514 b] is noteworthy. Its fragmentary nature prevents conclusive interpretation, but its context seized our attention

because sesame oil contains the lignans sesamin and sesamolin that are powerful natural insecticides or insecticidal synergists (Bedigian, Seigler and Harlan, 1984). Also in this regard, a candy manufacturer in Khartoum told DB that he often wondered why ants avoided the *halva* (*tahneeya*) candy made of crushed sesame seeds with sugar, stored in his warehouses, although they were strongly attracted to the other sweets in his inventory (Hassan Daoud, owner of Saad Sweets, pers. comm., 1980).

The estimation of the rising of Sirius given by Kraus (1968) seems late by our calculation. If one takes precession into consideration, the date for the rising of Sirius ca. 3000 B.C. should have been June 22 (W. Doyle, pers. comm.; J. Kaler, Dept. of Astronomy, Univ. Illinois, pers. comm.). This fact further favors identification of sesame as the summer-planted oilseed.

No sesame pollen has been found archaeologically, except for a single grain reported by Woosley (1976). Mindful of possible contamination from modern cultivation, the find of a single pollen grain cannot be viewed as substantial evidence.

SUMMARY AND CONCLUSIONS

The evidence indicates that the sesame crop is of Indian origin and has some archaeological presence at Harappa. It is well documented in Armenia, Arabia, Anatolia and Greece by the 1st millennium B.C.

Earlier evidence from Mesopotamia is linguistic only. Cuneiform texts confirm the seasonal separation of winter-grown barley and summer-sown **še-giš-î**. The possibility of transfer of the Dravidian word and the crop *ellu* from the Indian subcontinent needs support from philologists to establish a connection with the Mesopotamian word *ellu*.

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A RENTAL OF TOOLS USED IN PROCESSING SESAME

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Tools used for extracting sesame oil are listed in only a few Old Babylonian texts: BIN 7 218, YOS 12 342 and A. 32086. They are discussed at the end of Stol's article on sesame in this volume (p. 122). Here, we publish A. 32086, a text from the Tablet Collection of the Oriental Institute of the University of Chicago. We thank the Oriental Institute for giving permission to publish this text.

Transliteration: (Obv.) 1 *1 [k]a-an-nu-um* ša *ṣa-ha-ti* 2 *1* **na$_4$** *e-ru-ú* **ì.giš** 3 *1 e-sí-tu* **ì.giš** 4 **ki** *i-din--*^{d}*na-na-a* 5 p *a-wi-il-ja* 6 *a-na* **itu.4.kam in.hun.gá** 7 **á itu.4.kam** 8 **4 sila$_3$ ì.giš** (Rev.) 9 **ì.ág.e** 10 **igi** ^{d}**utu-***mu-uš-ta-al* 11 **igi** *i-bi--*^{d}**utu** 12 **kišib lú.inim.ma.bi.meš** 13 **íb.ra.aš** 14 **itu.du$_6$.kù u$_4$.30.kam ba.zal** 15 **mu** *ṣa-am-ṣu--i-lu-na* **lugal** 16 **si.bi**

Translation: Awilja rented for four months from Iddin-Nana: one *kannum* for extracting, one grindstone for oil, one pestle for oil. (As) rent of 4 months he will deliver four *qâ* of oil. Witness: Šamaš-mušṭal; witness: Ibbi-Šamaš. They applied the seals of the witnesses.
Month VII, day 30, year of king Samsu-iluna ...

"The obverse and reverse as well as the upper, left, and lower edges are covered with seal impressions. I did not copy them because: 1) there are at least two different seals (although apparently only one of them was inscribed); 2) none of the impressions is complete; 3) the inscription was impressed two lines at a time and I cannot reconstruct the proper sequence of lines in the inscription, nor can I be certain that I can see all the lines of the inscription; 4) the two more or less complete lines that I can see don't make much sense to me..... What I can see is three divine names on three separate lines, ^{d}EN.[ ], ^{d}DAM.[ ], ^{d}NIN.[ ], plus what is apparently a name, *Na-ri- x* -AN, followed on the next line by KA NIR KA/SAG [X]. Next to a standing figure at the edge of the design is ^{d}UTU ^{d}*A-a*. The *x* in the name is a rectangular sign that could be MA, BA$_4$, GIŠ, or IŠ. Of course, it looks slightly different in each impression. Neither of the names of the witnesses listed in the text is to be found in the seal inscription." (R.M. Whiting, letter of 13 August, 1985)

*The copy and description of the tablet are by Whiting, the edition and comments by Stol. We would like to thank R.M. Whiting for responding most promptly to our plea for help [Ed.].

The man who rents the tools, Awilja (or: Awelija), is known from many other texts, dated to Samsu-iluna years 7 to 8. From the evidence collected by D. Charpin, BiOr 38 (1982) 535f. "Archives L: Awīliya, *rā'ibānum*", he appears to deal mainly in sesame and oil. More texts probably centering around this man are: Riftin 1937 no. 8; AUAM 73.2216 (Andrews University, unpublished; no. 555 in M. Sigrist's forthcoming edition); cf. AbB 9 no. 274 rev. 4'.

Our contractants, Awelija and Iddin-Nana, are both witnesses in YOS 12 336:18-19.

The year-name is unfinished but should be one of the first ten years of Samsu-iluna.

A. 32086